

# A MONOGRAPH OF THE GENUS *PHEIDOLE* IN FLORIDA (HYMENOPTERA: FORMICIDAE)<sup>1</sup>

By  
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## INTRODUCTION

The genus *Pheidole* is one of the more important ant genera in the world. Approximately 1000 species are now known. Over 400 of these are found in the Neotropical region (Kempf, 1972), and about 75 taxa are known from North America north of Mexico. *Pheidole* spp. are abundant in many areas, and live in varying habitats ranging from the humid tropics to deserts. They are able to survive in some areas by their habits of collecting and storing seeds as food resources. They are also scavengers of dead insects and other animals, and can be predacious. Some species tends aphids and other homopterans, but this food source, so important to many ant species, is probably of relatively minor importance to most species of *Pheidole*.

*Pheidole* apparently is a genus of rather recent evolutionary development. No fossil *Pheidole* are known previous to the Miocene (Brown, 1973). No *Pheidole* occur in Baltic amber (lower Oligocene) although these ambers contain large numbers of specimens of other ant genera which have persisted almost unchanged since that epoch (species of *Formica*, *Myrmica*, *Iridomyrmex*, *Camponotus*, and others). It has been said that *Pheidole* has undergone a world wide dispersal since this time and has undergone a large proliferation of taxa as well as adaptation to many ecological niches (Brown, 1973).

A study of the *Pheidole* of any area is one of the prerequisites to understanding the formicid interactions of that area, and this in turn could be important in the development of pest management strategies. Ants are probably the most numerous and most important animals within their size range.

One species, *Pheidole megacephala*, has become a tropicopolitan tramp species and is a serious pest in various areas (Wheeler, 1910; Flucker and Beardsley, 1970; and Lieburg, 1975). Some species sting severely and are comparable with the fire ants in aggressiveness (Buren, personal communication). Most of the species, however, appear innocuous and are usually unnoticed by man. Their importance in the ecosystem appears largely unappreciated.

Due to its size and distribution, *Pheidole* is a very difficult genus and has been a challenge to myrmecologists taxonomically as well as biologically.

Until recently only eleven species were known from Florida, which suggests that, despite its subtropical warmth, Florida was deficient in *Pheidole* when compared to Texas (36 species) and Arizona (26 species). The Florida *Pheidole* fauna has long been known to be more extensive than that of northern states such as Iowa and New Jersey (3 species each, Buren, 1944; Creighton, 1950).

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With the help of keys and scanning electron micrographs it is now possible to identify, with relative ease, both the majors and the workers of the species of this genus known to occur in Florida.

**REVIEW OF LITERATURE.** Four of twelve species reported from Florida have that state as the type locality of the species: *P. dentata* Mayr (1886), *P. floridana* Emery (1895), *P. metallescens* Emery (1895), and *P. sitarches litorallis* Cole (1952).

Smith (1930) reported *P. morrisi*; Wheeler (1932) reported *P. anastasi*; Smith (1933) reported *P. megacephala*; Smith (1944) reported *P. dentigula*; Smith (1951) reported *P. flavens sculptior* (misidentification); Van Pelt (1956) reported *P. pilifera*; Smith (1958) reported *P. bicarinata vinelandica*, and Wojcik *et al.* (1975) reported *P. moerens*. Additional information is discussed under each species by the respective authors.

Creighton (1950) was the first to try to give an extensive key to the North America *Pheidole*; 63 species were listed, and he used morphological characters pertinent to both majors and workers. Creighton's statements about the North American *Pheidole* are as follows:

Most of our species of *Pheidole* possess a dimorphic worker caste with major and minor workers not connected by intermediates. In a few species, however, the worker caste is polymorphic (*P. kingi*, *P. instabilis* and *P. torpescens*, *P. vasliti arizonica*, etc.). Most of the species garner seeds and it is believed that the large-headed major workers function as seed-huskers. The enlarged head of the major is mainly filled with mandibular muscles. This enables the jaws to exert much pressure, which should be useful in cracking off the husks of seeds. It may be added that sometimes the head of the major is so large in proportion to its body that if the insect is turned over on the back of its head it cannot regain a normal posture without help from other workers. Despite their preference for a graminivorous diet many species of *Pheidole* will accept other food as well. They seem less attracted to honey-dew than do many ants but will often feed voraciously on animal tissue when the opportunity offers. The majority of our species form small colonies. In many cases there are only about two or three hundred individuals in a fully developed nest. Even in the case of the species which produce comparatively large nests (*P. morrisi*, *P. hyatti*, *P. desertorum*, etc.) a colony of more than two or three thousand individuals would be exceptionally large. By far the majority of our species nest in soil. The nest may be built under a stone or in open soil without a covering object. In the latter case there is often a mound or craters

of excavated soil surrounding the nest entrance. The eastern species *dentata* will nest in rotten logs as well as soil but such flexibility in nesting habit is exceptional.  
(p. 162)

Gregg (1958), published a new revision in which he included the description of ten new taxa. He also placed ten taxa in synonymy and the status of eight taxa was revised. Later, Gregg (1969) described another new species, *P. clementensis*.

Smith (1967) reported *P. moerens* from Alabama as yet another exotic species. This was the 71st *Pheidole* taxon reported for North America north of Mexico. Wojcik *et al.* (1975) reported that this species was also present in Florida.

**MATERIALS AND METHODS.** Three species of *Pheidole* (*P. dentigula*, *P. fallax obscurithorax*, and *P. greggi* n. sp.) included in this research were received from other collectors. All other specimens were collected by the author during several trips in the state or while at Tall Timbers Research Station in Leon Co., Florida, during the summers of 1974 and 1975.

Colonies of *Pheidole* spp. were located in several ways:

- a. Examining cavities under the bark of trees or examining grass behind the leaf bases of palms.
- b. Searching for nest craters, mounds, or any other modification on the soil surface likely to have been produced by ants.
- c. Searching for foraging majors or workers and following them to the nest location.
- d. Baiting with honey or dead arthropods and following trails of workers and majors to the nest location.
- e. Overturning stones, boards, or pieces of wood.

The two most successful methods were examining cavities under the bark of pine trees and looking for craters on the soil surface.

Colonies were collected by aspirating the ants once the chambers were located. Nests in the soil were excavated by removal of large blocks of soil, breaking it carefully and aspirating the ants found. The depth explored was variable, ranging from 30 to 50 cm for *P. metallescens* to over 1.5 m for *P. lamia*.

The ants were placed in snap-cap vials with 70% alcohol for preservation or kept alive in snap-cap vials with a piece of moistened cotton to ensure adequate survival. The snap-cap vials were placed in a styrofoam box to protect them against excessive changes in temperature during transport back to the laboratory.

The colonies were kept in chambers made from petri dishes modified to assure proper high moisture levels and ease of feeding and observation without disturbing the colony.

Plastic petri dishes 9 cms in diameter were used. A 0.5 cm hole was melted by a soldering iron toward the side of the bottom of one dish. A piece of artificial cotton matting was pushed half way through the hole and was coated inside with a mixture of plaster of paris (98%) and commercial cement (2%). The matting below the hole was kept continuously wet with distilled water and was retained in another petri dish bottom. It did not need to be replenished with water frequently. The nest chamber was formed by applying the petri dish top and sealing with tape. A small feeding chamber which remained dry was formed by affixing another petri dish bottom to the petri dish top of the nest

chamber with an interconnecting exit hole. This construction allowed colonies to be maintained in the laboratory for long periods with only infrequent attention. The dry feeding area separated from the nest chamber inhibited the growth of molds. Large numbers of colonies were thus kept in a small laboratory space.

Colonies were fed with freshly killed house-flies, fresh peanuts, and honey.

Whenever possible field observations were made concerning the ecology and biology of each species.

Types in the Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, and the National Museum of Natural History in Washington, D.C., of Nearctic and Neotropical *Pheidole* were studied.

All specimens were point mounted and studied by using a stereo microscope with magnification up to 160X. The pictures were taken using the scanning electron microscope of the Insects Attractants Laboratory, Agricultural Research Service, U.S.D.A., Gainesville, Florida.

Several measurements were made for the newly described species:

- a. Body length: the sum of the head length, thoracic length, pedicel and gastric lengths.
- b. Head length: lengths of the head in full face view (mandibles excluded).
- c. Head width: greatest width of the head in full face view.
- d. Thoracic length: greatest length of thorax in lateral view.
- e. Scape length: middle of antennal socket to the scape tip.
- f. Scape index: found by computing the formula:

$$\frac{\text{Scape length} \times 100}{\text{head length}}$$

The following abbreviations were used throughout this work:

MCZC - Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

USNM - United States National Museum, Washington, D.C.

AMNH - American Museum of Natural History, New York, N.Y.

#### KEY TO SPECIES OF *PHEIDOLE* OF FLORIDA (MAJORS ONLY)

- 1 a. Head cylindrical in cross section and obliquely truncate anteriorly, the truncation involving the clypeus, frontal area, anterior portions of genae, and mandibles. (fig 1)..... *lamia* Wheeler
- b. Head not cylindrical in cross section and not truncate anteriorly..... 2
- 2 a. Antennal scape strongly bent, flattened and smooth at the base, the base nearly as or as broad as the distal portions of the scape (fig 2)..... 3
- b. Not as above, scape not flattened at base and usually distinctly narrower than distal portion; if thickened and strongly bent at base, obviously not flattened..... 4
- 3 a. First gastric tergite covered with very numerous long and short erect hairs; sometimes sparse, coarse, appressed, pubescence is present. (fig 3, 4) ... *diversipilosa* Wheeler

- b. First gastric tergite covered with appressed pubescence and sometimes with sparse long hairs. (fig. 5, 6)..... *crassicornis* Emery
- 4a. Large species, total length over 6 mm; head heavily sculptured; scapes very thick and bent at base. The scapes seen in full face view are evenly curved mesally, but more angular laterally (fig. 7, 8).... *fallax obscurithorax* Santschi
- b. Species usually measuring 5 mm or less; if larger the head never heavily sculptured; the scapes never thick or strongly bent at base..... 5
- 5a. Head cordate, gradually but distinctly narrowed toward the mandibular insertions; broadest at the occipital lobes; mesonotum but not transversely impressed. (fig. 9)..... *megacephala* (Fabricius)
- b. Head not cordate and never strongly narrowed towards the mandibular insertions; mesonotum may or may not be transversely impressed..... 6
- 6a. Postpetiole, seen from above, bearing distinct lateral connules; head covered with reticulate punctation or longitudinally striate. (fig. 10, 11)..... 7
- b. Postpetiole seen from above, without distinct lateral connules; if indistinct lateral projections present the posterior half of the head smooth and shining. (fig. 12)..... 11
- 7a. Occipital lobes with reticulate sculpture, with no trace of transverse or longitudinal striation, the surface opaque or feebly shining; post-petiole width two times length. (fig. 13)..... *dentigula* M. R. Smith
- b. Occipital lobes smooth and shining or with sparse punctures or striae; postpetiole width greater than length, but never two times length. (fig. 10, 11)..... 8
- 8a. Sides of head sub-parallel, narrowing slightly anteriorly; head length 1.82 to 2.0 mm; scape index 41 to 42; pronotum and mesonotum strongly sculptured with transverse and sometimes with longitudinal rugae; dorsal crest of petiole notched. (fig. 14)..... *carrolli* n. sp.
- b. Without all the above characters..... 9
- 9a. Erect gastric hairs sparse, tapered and almost all of the same size; posterior part of the head covered with sculpture; anterior ventral margin of the head without teeth; body sometimes with distinct violaceous or bluish metallic reflections. (fig. 15, 16)..... *metallesens*
- b. Gaster covered with long and short hairs; posterior part of the head smooth and shining (fig. 17); anterior ventral margin of the head with two or three teeth, the mesal tooth usually short and blunt. (fig. 30)..... 10
- 10a. Dorsal surface of first gastric tergite finely and densely granulose, opalescent and opaque; dorsal areas of pronotum punctate and sometimes with several short and fine transverse striae; dorsal area of post-petiole punctate. (fig. 17, 18)..... *anastasii* Emery
- b. Dorsal surface of first gastric tergite smooth and shining; dorsum of pronotum partially weakly punctate but also interdispersed with smooth and shining areas; dorsal area of post-petiole weakly punctate and shining. (fig. 10, 19)..... *floridana* Emery
- 11a. Head covered with longitudinal striae; the dorsal area of the pronotum and usually the mesothorax reticulo-punctate and with transverse striae or sculpture. (fig. 20)..... 12
- b. Posterior areas of the head smooth and shining; the pronotum, seen from above, smooth and very shining.... 14
- 12a. Head usually measuring over 1.4 mm in length and 1.1 mm in width; sides of the head sub-parallel; scape length shorter than half the head length (Scape Index around 40); occipital lobes with distinct circular piligerous punctures. (fig. 12, 20)..... *littoralis* Cole
- b. Head measuring less than .9 mm in length and width; occipital lobes smooth and shining..... 13
- 13a. Frontal area concave and bearing 1 or 2 longitudinal striae. Scrobes strongly punctate and opaque; occipital lobes smooth and weakly shining; on occiput intersitial spaces between striae reticulo-punctate. (fig. 21).... *greggi* n. sp.
- b. Frontal area concave, without longitudinal striae; posterior half of the scrobe weakly punctate and shining; occipital lobes and most of the head shining; on front, intersitial spaces between striae smooth and shining. (fig. 22)..... *moerens* Wheeler
- 14a. Anterior clypeal margin bluntly bidentate, with deep median notch; anterior ventral margin of head without teeth. (fig. 23)..... *vinelandica* Forel
- b. Anterior clypeal margin not bidentate and without notch; anterior ventral margin of the head usually with two or three teeth; if teeth are absent, shining black species... 15
- 15a. Mesonotum without transverse impression, forming in profile a continuous smooth curve with the pronotum. (fig. 26)..... 16
- b. Mesonotum, with a well developed transverse impression... 17
- 16a. A yellow species; frontal area and middle of front smooth and shining without striae; anterior ventral margin with 3 teeth; thorax smooth and shining..... *tysoni* Forel
- b. A black species; anterior half of head with longitudinal striae; dorsum of pronotum smooth and shining; pleurae of pronotum, mesonotum, and propodeum heavily sculptured. (fig. 25, 26)..... *adrianoi* n. sp.
- 17a. Propodeum angular at the junction of the basal and declivous faces, but the angles not produced into distinct teeth or spines. (fig. 27, 28)..... *morrisi* Forel
- b. Propodeum armed with distinct teeth or spines. (fig. 29)..... *dentata* Mayr

**KEY TO PHEIDOLE SPECIES OF FLORIDA  
(WORKERS ONLY)**

- 1a. Entire head smooth and shining. (fig. 31, 36)..... 2
- b. Head reticulo-punctate or partially reticulate with some smooth areas. (fig. 40, 41, 44)..... 9
- 2a. Scapes failing to reach the posterior border of the head, or surpassing it by an amount no greater than the first funicular joint. (fig. 31)..... 3
- b. Scapes surpassing the posterior border of the head by an amount greater than the first funicular joint. (fig. 34).... 6
- 3a. Thorax smooth, nearly free of sculpture and strongly shining yellow..... 4
- b. Pronotum smooth and shining; mesonotum and propodeum punctate or sculptured; color various (fig. 32, 33)..... 5
- 4a. Propodeum armed with angular teeth which are broad at the base and do not resemble spines; mesonotum and propodeum in profile separated by a deep, wide impression. (fig. 31)..... *lamia* Wheeler

- b. Propodeum armed with spines; mesonotum and propodeum in profile separated by a normal impression... *tysoni* Forel
- 5a. Yellowish to brownish species, gaster covered with numerous long fine hairs. (fig. 32)..... *vinelandica* Forel
- b. Ebony black species, gaster with plumose or subplumose hairs which are spaced at distances more or less equal to the hair's length (fig. 33)..... *adrianoi* n. sp.
- 6a. Mesonotum without a distinct transverse impression; in profile postpetiole longer than petiole and dorsal and ventral outlines both smoothly convex. (fig. 34)..... *megacephala* (Fabricius)
- b. The mesonotum with a distinct transverse impression. (fig. 35, 37, 39)..... 7
- 7a. Posteriorly on head a distinct collar visible in full face view (fig. 36); the mesonotum and base of propodeum heavily punctate. (fig. 35)..... *fallax obscurithorax* Santschi
- b. Posterior collar of head not visible in full face view; the mesonotal dorsum and propodeal base weakly sculptured and shining..... 8
- 8a. Usually yellowish or pale species, the propodeal spines absent (fig. 37)..... *morrisi* Forel
- b. Dark brown to ferruginous species; propodeal spines well formed. (fig. 38, 39)..... *dentata* Mayr
- 9a. Scapes surpassing the posterior margin of the head by a distance greater than the first funicular joint. (fig. 40)... 10
- b. Scapes either not surpassing posterior margin of the head, or surpassing less than the length of the first funicular joint (fig. 43)..... 11
- 10a. First gastric tergite with appressed pubescence and only a few scattered long hairs..... *crassicornis* Emery
- b. First gastric tergite covered with numerous long and short hairs; pubescence usually erect or semi-erect, rarely appressed..... *diversipilosa* Wheeler
- 11a. Head not completely punctate, the front of the head with irregular smooth and shining areas. (fig. 42)..... 12
- b. In full face view, head entirely covered with reticulate punctation or with longitudinal striae. (fig. 43)..... 13
- 12a. Pleurae of pronotum heavily reticulate; head, thorax and gaster usually with distinct violaceous or bluish metallic reflections; eyes with less than 30 facets. (fig. 41)..... *metallescens* Emery
- b. Pleurae of pronotum smooth and shining, body without violaceous or bluish reflections; eyes with more than 45 facets. (fig. 42)..... *littoralis* Cole
- 13a. Eyes large, with more than 40 facets. (fig. 43)... *carrolli* n. sp.
- b. Eyes small, with less than 25 facets. (fig. 50, 51)..... 14
- 14a. Postpetiole small, little wider than the petiole. (fig. 44)..... *moerens* Wheeler
- or (fig. 45)..... *greggi* n. sp.
- b. Postpetiole nearly or more than twice as wide as the petiole. (fig. 47)..... 15
- 15a. Body and mainly the gaster covered with numerous fine long hairs; gaster enlarged, larger than the thorax; the propodeal spines very thick and obliquely curved and pointed laterad; first gastric tergite opalescent and subopaque; mermithid parasitized worker of *P. anastasioi* Emery (fig. 46, 47)..... *P. anastasioi* Emery
- b. Not with this combination of characters..... 16
- 16a. Postpetiole without lateral angles, hairs slender and pointed; postpetiole and gaster smooth and shining (fig. 48)..... *dentigula* M. R. Smith
- b. Postpetiole with angular sides, seen from above; hairs short and thick..... 17
- 17a. Dorsal surface of first gastric tergite finely and densely granulate, opalescent and subopaque; dorsum of pronotum and mesonotum punctate; dorsum of postpetiole punctate and opaque. (fig. 50)..... *anastasioi* Emery
- b. First gastric tergite smooth and shining, dorsal area of postpetiole weakly smooth and shining, dorsum of pronotum usually with partial smooth shining areas. (fig. 51)..... *floridana* Emery

### 1. *Pheidole adrianoi* - NEW SPECIES

A small ebony black species differing from *P. metallescens* by the absence of the violaceous or bluish reflections and without the reticulate sculptured occipital lobes. It also differs from *P. littoralis* by the small shining head, the head length usually less than 1.0 mm in the major as opposed to over 1.4 mm in *P. littoralis*; workers with the erect hairs plumose or semi-plumose at apex.

#### Description of the Major:

Body length 2.70 to 3.10 mm. Head length 0.82 to 0.97 mm; head width 0.79 to 0.95 mm. Thorax length 0.79 to 0.90 mm; scape length 0.45 to 0.51 mm. Scape Index 51 to 59.

**Head** shape as in fig. 25. Head, excluding mandibles, usually slightly longer than wide, broadest behind the eyes from where the sides slightly curve and narrow posteriorly, the occipital excision gently concave. Frontal area impressed; anterior border of clypeus with a wide, shallow median notch. A weak, scarcely depressed antennal semi-scrabe present; a distinct frontal furrow arising behind the frontal area, widening posteriorly into the occipital excision. Scapes slender at base, thickening apically and longer than half the head length; mandibles stout, weakly curved laterally, with two apical blunt teeth and two basal denticles. Eyes small with approximately 35 facets.

**Thorax.** Pronotum and mesonotum strongly convex in profile, posteriorly the mesonotum more abruptly descending into the mesopropodeal impression. Mesonotum without transverse impression; spines thick and long but blunt apically and pointed obliquely dorsad.

**Abdomen.** Petiole stout, anterior and posterior faces sloping, the crest weakly angular in profile. Seen from above, the sides of post petiole semi-angular, the lateral projections blunt and not well developed; gaster truncate at base and smaller than head.

**Sculpture.** Strong cephalic longitudinal striae diverging posteriorly and disappearing in the area posterior to the scape when in repose; interstitial areas between striae with weak, fine reticulate punctation; frontal carinae diverging and surpassing the scapes when in repose; vertex, frontal area as well as the clypeus smooth and shining, the semi-scrabes not distinct and marked only by lack of sculpture; the genae with strong longitudinal striae, the interstitial areas weakly reticulo-punctate; occipital lobes smooth and shining with sparse small circular piligerous punctures, ventral surface of head smooth and

shining, its anterior margin without teeth; frontal furrow with its posterior half bearing transverse rugules.

Seen from above, dorsum of the pronotum and anterior mesonotum nearly smooth and weakly shining, mesopropodeal impression and adjacent posterior area of mesonotum reticulo-punctate; basal area of propodeum weakly reticulate and shining; declivous face usually shining.

In profile, pronotum, mesonotum and propodeum heavily reticulate, the inner areas finely reticulo-punctate and shining; petiole finely reticulo-punctate. Seen from above, dorsum of pronotum and anterior mesonotum nearly smooth and weakly shining; mesopropodeal impression and adjacent posterior area of mesonotum reticulo-punctate; basal area of propodeum reticulate and shining; declivous face with transverse striae and usually the interstitial areas finely reticulo-punctate and shining; several fine interspinal striae present; dorsum of postpetiole weakly sculptured or almost smooth and shining.

**Pilosity.** Hairs yellow, fine, numerous and of various lengths, measuring 0.07 to 0.18 mm; dorsal and ventral surface of head with semi-erect short and long hairs; dorsum of pronotum and mesonotum with numerous predominantly long erect hairs; propodeal base with few scattered short hairs; pedicel with numerous semi-erect long hairs; gaster with numerous predominantly long semi-erect hairs, most of them blunt apically. Pubescence on antennae, sparse on legs and absent on gaster.

**Color.** Head and gaster ebony black; thorax and legs a little lighter.

#### Description of Worker

**Body** length 1.50 to 1.60 mm. Head length 0.44 to 0.51; head width 0.38 to 0.41 mm. Thoracic length 0.46 to 0.51 mm. Scape length 0.40 to 0.46 mm. Scape Index 97 to 106.

**Head,** excluding mandibles, slightly longer than broad; occipital border slightly concave medianly; frontal area shallowly depressed; frontal carinae straight, short and slightly divergent; scapes surpassing the occipital lobes by an amount less than the first funicular joint; mandibles slender, apically with two sharp teeth, the remaining masticatory border with several smaller denticles.

**Thorax.** Pronotum and mesonotum, in profile, convex; propodeal spines long but blunt, projecting obliquely dorsad.

**Abdomen.** Petiole stout, the apex of the node angular; postpetiole strongly convex dorsally and almost flat ventrally; gaster truncate at the base.

**Sculpture.** Head smooth and strongly shining; pleural surfaces of pronotum shining; pleurae of mesonotum, propodeum and petiole strongly reticulo-punctate, postpetiole weakly punctate.

Seen from above dorsum of pronotum and anterior mesonotum smooth and strongly shining, posterior area of mesonotum, propodeal base and propodeal declivity reticulo-punctate; dorsum of postpetiole and gaster smooth and shining.

**Pilosity.** Hairs white, measuring less than 0.08 mm; sparse all over the body, semi-erect and of mixed sizes on the head, long and erect on the dorsum of thorax and long and slender on gaster; under the stereo microscope the hairs seemed spatulate, but scanning micrographs later revealed that such hairs are branched at the tips (fig. 53, 54), therefore, plumose or sub-plumose.

**Color.** Ebony black, the appendages lighter, mandibles yellowish to dark brown.

#### Description of Females

**Body** length 4.60 mm. Head length 0.90 mm; head width 0.95 mm. Thoracic length 1.46 mm. Scape length 0.51 mm. Scape Index 58.

**Head** broader than long, broadest posteriorly; occipital border slightly concave; sides slightly convex and narrowing anteriorly toward the mandibular insertions; anterior border of clypeus weakly notched in the middle. Frontal area depressed; antennae like those on the major; scapes longer than half the head length; eyes measuring about 0.24 mm in diameter and located on anterior half of head; ocelli measuring about 0.12 in diameter.

**Thorax** flat dorsally, narrower than the head measured through the wing insertions. Mesoscutum and scutellum well separated; propodeal base and declivous face not forming a distinct angle.

**Abdomen.** Propodeal spines stout, blunt and directed posteriorly; petiole stout, the node seen from above with parallel sides, the crest slightly depressed in the middle; postpetiole twice as wide as petiole, with rather angular lateral projections; gaster truncate at the base.

**Sculpture.** Cephalic rugae strong, covering most of the anterior part of the head, but disappearing before reaching the occipital border, the interstitial areas between rugae with widely spaced weak reticulate punctation; frontal area smooth and shining with two mesal longitudinal striae; frontal carinae long and diverging posteriorly.

Sides of pronotum and propodeum reticulate; episternum smooth and shining; propodeal base and declivous face smooth and shining; petiole and postpetiole punctate and opaque; gaster, seen from above, with fine longitudinal striae near the base, the interstitial areas between striae shining but with widely spaced reticulate punctation, the rest shining and with circular piligerous punctures.

**Pilosity.** Hairs yellow, pointed; dorsum of thorax, pedicel and gaster with numerous short and long hairs; gaster usually more pilose than the remaining parts; pubescence present on the antennae and legs.

**Color.** Reddish brown; the gaster darker.

**Male Unknown.** This species is named in honor of my beloved first born son, Adriano de Resende Naves.

**Holotype.** Major from Gainesville, Florida, collected by M. A. Naves.

**Paratypes.** The type material comprises 30 majors and 60 workers collected in Gainesville, Florida from several colonies on August 13, 1975 and 25 majors and 33 workers from several colonies from Archbold Biological Research Station at Lake Placid, Florida, in August, 1975. All were collected by M. A. Naves.

The holotype and several paratypes are deposited at the Florida State Collection of Arthropods, Division of Plant Industry, Gainesville, Florida and in the M. A. Naves collection.

### Discussion

This species is fairly common in Florida. Its range seems to be from central to northern Florida. It may also occur in southern Georgia. Its preferable habitat seems to be sandy soils, in clear areas among trees, the same habitat as in *P. metallescens*, with which it is very similar to the naked eye.

The colonies have about 60 majors and more than 300 workers. The main chamber is located 30 to 40 cm deep in the soil and is directly connected to a vertical tunnel of about 1 to 2 mm in diameter, which usually is the center of a small crater on the soil surface. The main flights of sexuals occur in the summer in July and August. The species is entirely diurnal. The main sources of food are small seeds, although it also scavenges small dead arthropods. The majors as well as the workers usually forage for food and help carry it back to the colony. It is not an aggressive species. The majors, when disturbed, try to escape to hiding places.

*P. adrianoi* differs from *P. metallescens* by its ebony black color, absence of reticulate punctation on the head and by its smooth and strongly shining occipital lobes and lack of metallic reflections. *P. adrianoi* also differs from *P. littoralis* by its small head, and the occipital lobes not strongly rounded, sides of head not parallel and mandibles not stout and strongly curved. *P. metallescens* and *P. littoralis* usually have a reddish brown head and thorax, the gaster always darker or blackish as opposed to *P. adrianoi* which has a shining concolorously ebony black body.

### 2. *Pheidole anastasii* Emery

*P. anastasii* Emery, 1896. Soc. Ent. Ital., Bol. 28:76. - Forel, 1901. Naturhist. Mus. Hamburg, Mitt. 18:78. - Wheeler, 1932. N.Y. Ent. Soc., Journ. 40:6. - Smith, 1933. Fla. Ent. 17:23. - Creighton, 1950. Bull. Mus. Comp. Zool. 104:169. - Gregg, 1958. N.Y. Ent. Soc. 66:16.

*P. floridana* Van Pelt, 1956. Amer. Midland Nat., 56:376, 384. Carroll, 1970. Unpublished M. S. thesis, University of Florida, p. 32-34. - Whitcomb, Denmark, Bhatkar, and Greene, 1972, Fla. Ent., 55:133. (*nec* Emery).

**Type locality.** Jimenes, Costa Rica

**Types.** None in the United States.

**Range.** Florida, southern Alabama and Georgia.

### Diagnosis

This species is small, yellowish, differing from *P. floridana* in having opalescent surfaces dorsally on the first gastric tergite; differing from *P. moerens* and *P. greggi* n. sp. by having the postpetiole twice as broad as the petiole. Distinct lateral connules are present. It differs from *P. dentigula* in having smooth and shining occipital lobes.

### Discussion

Wheeler (1932) reported *P. anastasii* (fig. 17) from Florida. It is unlikely that it is an introduced species as Wheeler suggested. I have found this species throughout Florida from the keys to the Panhandle. Its constant nesting at the base of pines

and the occurrence of two parasites, a mermithid that parasitizes the workers (fig. 46, 47) and a hymenopteran parasite species of the genus *Oraesema*, seem to contradict Wheeler's suggestion that *P. anastasii* is an exotic species.

Due to the close resemblance of this species to *P. floridana* Emery, *P. anastasii* probably has been misdetermined in several records from Florida.

The lack of access to Emery's types of *P. anastasii* makes it difficult to determine if the Florida species is conspecific with the Costa Rican types. Wheeler, however, did have knowledge of the types of *P. anastasii* when he reported it from Florida.

*P. anastasii* was usually found nesting under the bark at the base of pines or along the roots and only rarely in the soil. The colonies are monogynous and have more than 100 majors and over 500 workers. Several chambers are constructed interconnected by a string of galleries under the pine bark. The workers forage over 4 m from the colony and once food is located majors are recruited to help transport it back to the colony. It feeds on seeds, fruits, and scavenges on small dead arthropods and is predaceous on small live arthropods.

Laboratory colonies are very easy to keep and usually accept members of other colonies. Colonies that have lost their queens will also accept any other queens of *anastasii*. Several times I collected two or three nest founding females found together in one chamber. In the lab one female always killed the others before the first workers were reared.

### 3. *Pheidole carrolli* - NEW SPECIES

This is a reddish brown species related to the *P. pilifera* group. It differs from *P. pilifera* and *P. pilifera artemisia* by the absence of coarse reticulate occipital rugae and blunt postpetiolar connules. It differs from *P. pilifera coloradensis* by its larger head, strongly convex pronotum and anterior mesonotum, and longer and finer thoracic and gastric hairs. It differs from *P. pilifera pacifica* by its larger size and cephalic rugae extending to the occipital lobes and absence of transverse occipital rugae.

### Description of Major

Body length 3.20 to 3.60 mm. Head length 1.80 to 1.90 mm; head width 1.69 to 1.80 mm. Thoracic length 1.36 to 1.44 mm. Scape length 0.77 to 0.82 mm. Scape Index 42 to 44.

**Head shape** as in fig. 14. Head, excluding mandibles, longer than broad, occipital lobes prominent and well rounded, separated by a broad and deep excision; a furrow present, starting from the frontal area to the occipital excision. Frontal area depressed and bearing a median longitudinal striation. Clypeus with a weak median carinae which is continuous with the frontal area striation; anterior border of clypeus with a shallow weak emargination; frontal carinae divergent; anterior ventral margin of the head without teeth; scapes slender at base, thickening apically and measuring less than half the head length. Mandibles stout, strongly curved laterally and with two apical large blunt teeth, the remaining border edentate, except for a small basal tooth-like lobe. Eyes small, measuring about 0.25 mm in diameter with over 60 facets and located on the anterior third of the head.

**Thorax.** Seen from the side, thorax smaller than head,

pronotum and anterior mesonotum strongly convex; posterior of mesonotum descending to the mesopropodeal impression, forming an obtuse angle with the propodeal base.

**Abdomen.** Base of propodeum slightly shorter than declivity; propodeal spines short and projecting dorsad; petiole, in profile, stout and with a short anterior peduncle, anterior face gently curved and posterior face short; apex of node weakly angular to moderately convex; seen from above the sides of the petiole parallel and the node notched in the middle; postpetiole in profile strongly convex dorsally, slightly concave and much shorter ventrally; seen from above, postpetiole two times or more wider than petiole and with lateral connules; gaster oval and much smaller than the head.

**Sculpture.** Cephalic longitudinal rugae extending posteriorly and somewhat divergently; the lateral rugae usually do not reach the occipital lobes; occipital lobes smooth and shining laterally and dorsally; rugae present on the genae, extending longitudinally; posterior to the eyes the surfaces smooth and shining; head posteriorly with coarse circular piligerous punctures. Dorsum of pronotum and mesonotum with longitudinal or transverse rugae or both, the interstitial areas with fine reticulate punctation. The mesopropodeal impression wide and with longitudinal rugules, the interstitial areas smooth and weakly shining; the propodeal base and declivity finely reticulo-punctate and weakly shining. Several transverse striae present between bases of spines; petiole and postpetiole opaque and weakly reticulo-punctate; gaster smooth and shining except in the basalmost area where it is opaque and weakly punctate.

**Pilosity.** Hairs yellow, pointed, short and semi-erect and sparse on the anterior face of the head, short and long and semi-erect ventrally; dorsum of thorax with numerous short and long erect hairs measuring up to 0.26 mm; pedicel with numerous semi-erect short and long hair; sparse pubescence confined to antennae and appendages.

**Color.** Reddish brown, appendages lighter; dorsum of gaster slightly darker; anterior margin of clypeus and the border of mandibles dark.

#### Description of Worker

Body length 2.30 to 2.40 mm. Head length 0.56 to 0.64 mm; head width 0.56 to 0.58 mm. Thoracic length 0.74 to 0.77 mm. Scape length 0.53 to 0.59 mm. Scape Index 92 to 94 mm.

**Head** usually a little longer than broad, occipital borders weakly convex; frontal area impressed and with a longitudinal striation in the middle; frontal carinae slightly divergent; clypeus with a weak median carina and 2 longitudinal striae laterally; anterior border curved and without any notch. Mandibles slender with 2 large and sharp apical teeth and 4 or 5 smaller teeth on the remaining masticatory border; scapes usually surpassing the occipital border by an amount no greater than the first funicular joint; eyes large with about 45 facets and measuring about 0.15 mm in diameter. In profile, pro-mesonotum moderately convex; propodeal spines small, sharp, and projecting obliquely dorsad.

**Abdomen.** Petiole as in the major, except the crest is proportionately much broader; postpetiole convex dorsally and flat ventrally, seen from above the sides are strongly convex and almost 2 times wider than petiole; gaster oval.

**Sculpture.** Head reticulo-punctate and opaque; a few rugules on the genae, between the eyes and on the mandibles; thorax, in profile, reticulo-punctate; dorsum of pronotum and mesonotum usually with a few longitudinal or transverse striae; petiole reticulo-punctate; sides of postpetiole weakly punctate, dorsum weakly shining; gaster smooth and shining.

**Pilosity.** Erect hair yellow, short on the dorsal surface of head, longer on the ventral surface and anterior clypeal margin; long and sparse on thorax and pedicel; gaster with rather sparse hair of mixed lengths; pubescence confined to the antennae and legs.

**Color.** Reddish brown, sometimes the mandibles and legs are lighter.

**Holotype:** Major, collected near Gainesville, Florida by M. A. Naves.

**Paratypes:** 3 majors and 20 workers probably from the same nest as the holotype, collected as follows:

Dr. John F. Carroll collected one major and several workers on August 2, 1973, near Gainesville, Florida. M. A. Naves collected three majors and several workers in August, 1975, at the same locality.

The holotype major and 3 worker paratypes will be deposited at the Florida State Collection of Arthropods, Division of Plant Industry, Gainesville, Florida and in the M. A. Naves collections.

This species was also collected by me at Tall Timbers Research Station.

#### Discussion

This species has unusual behavior which is not common to other species of *Pheidole* known to me. It was always found in shaded areas in sandy soils among tall trees such as pines and oaks. It forages when the temperatures are not high and avoids direct sunlight. It is easily found at dusk or in the morning. The workers usually go out at random. Usually there are no more than 15 workers foraging at one time, and the foraging territory usually is within 5 meters from the nest entrance. The nest entrance is small and usually very hard to spot. The workers are sluggish compared with most other species. The majors are very rare. For a year two colonies were periodically checked and yielded only one callow major in 1975 and two majors in March, 1976. Dr. John F. Carroll also collected one major in the same locality in August, 1973. Periodic excavation usually also yielded a chamber approximately 4x2x2 cms located 30 cm deep and full of various seeds, some apparently with a black fungal mycelium. Although the excavation for one of these colonies at one time was 1.7 meters deep and 1.5 meters in diameter, I was unable to locate the main chamber or any majors or any sexual forms. Probably the main chamber or chambers are located very deep in the ground. It seems quite obvious that the colonies are not large. The disproportional size of the major and its rarity also seems to indicate that it has limited importance in sustaining the colony, which is not true for most species of the genus.

Another feature of this species when disturbed is the ability of the workers to feign death. The minors try to flex themselves around particles of soil which make them very difficult to see. The majors hide themselves and also seem to



avoid light, but their large size and more shining surfaces compared with the workers make them easier to spot.

Workers of this species, although not many, have been captured by baiting near Gainesville.

One colony was located at Tall Timbers Research Station in 1974, which failed to yield any major or sexual form.

Perhaps *P. carrolli* is a species which may be losing its major in the evolutionary process. The fewer majors available show rather more morphological variation than is normal in most *Pheidole* species.

This species is named after Dr. John F. Carroll, my friend and colleague during several years of graduate study at the University of Florida.

#### 4. *Pheidole crassicornis* Emery

*P. crassicornis* Emery, 1885. Zool. Jahrb., Abt. F. System. 8:289, 296. - Forel, 1901. Soc. Ent. Belg., Ann. 45:350. - Wheeler, 1904. Amer. Mus. Nat. Hist., Bul. 20:302. - Creighton, 1950. Bull. Mus. Comp. Zool. 104:175-176. - Gregg, 1958. N. Y. Ent. Soc., 66:20.

*Type locality.* Charlotte, North Carolina

*Types.* Cotypes, M.C.Z. and A.M.N.H.

*Range.* Southeastern United States

*P. crassicornis* (fig. 5) differs from *P. diversipilosa* and *P. crassicornis tetra* by the absence of erect and semi-erect hairs on the gaster. *P. crassicornis* can be easily distinguished from all Florida *Pheidole* other than *diversipilosa* by the basally strongly bent and flattened scapes.

#### Discussion

The finding of *P. crassicornis* at Gainesville and at Tall Timbers Research Station helps the understanding of this group because it is sympatric with *P. diversipilosa* at Tall Timbers. *P. crassicornis* is apparently confined to the northern part of Florida where it occurs in open areas, usually among trees. Its nests seem to be in deep soil. After digging as deep as 60 cm, I was unable to find any chambers of three colonies. The opening at the soil surface is hard to see. The typical craters common to other species were never observed. The major and workers were seen carrying live termites and other small dead arthropods. The workers and a few majors were observed foraging approximately 4 meters or more from the nest opening.

#### 5. *Pheidole dentata* Mayr

*P. morrisi* var. *dentata* Mayr 1886. Vehr. Zool. - Bot. Ges. Wein, 36:457.

*P. dentata* Forel, 1901. Ann. Soc. Ent. Belg., 45:351. - Wheeler, 1904. Amer. Mus. Nat. Hist., Bul. 20:302. - Mitchell and Pierce, 1912. Ent. Soc. Wash., Proc. 14:71. - Smith, 1918. Ent. News, 29:22. - Smith, 1924. Ent. News, 35:77. - Smith, 1930. Fla. Ent. 14:3. - Wheeler, 1932. N.Y. Ent. Soc., 40:6. - Dennis, 1938. Ent. Soc. Amer., Ann. 31:281, 304. - Van Pelt, 1950. Ent. News 61:161-163. - Creighton, 1950. Bull. Mus. Comp. Zool. 104:177. - Wheeler and Wheeler, 1953. Ent. Soc. Wash., Proc. 55:71. - Gregg, 1953. N.Y. Ent. Soc. 66:21-22. - Smith, 1965. U.S. Dept. Agr., Tech. Bul. 1326, pp. 27-28. - Wilson, 1975. Science 190:798:800.

*P. dentata* var. *faisonica* Forel, 1901. Ann. Ent. Soc. Belg., 45:352.

*P. commutata* Mayr 1886. Verb. Zool. - Bot. Ges. Wein. 36:459. - Emery, 1895. Zool. Jahrb. Syst., 8:289.

*Leptothorax tennesseensis* Cole, 1938. Amer. Midland Nat. 19:238.

*P. dentata* var. *commutata* Wheeler, 1907. Amer. Mus. Nat. Hist., Bull. 7:18. - Wheeler, 1908. Amer. Mus. Nat. Hist., Bull. 24:460-461. - Smith, 1924. Ent. News 35:77. - Cole, 1940. Amer. Midland Nat. 24:29, 44. - Smith, 1951. Cat. Hym. Amer. No. of Mex., U.S.D.A. Mon 2:802.

*Type locality.* Florida

*Types.* None in the United States

*Range.* Southeastern states, Tennessee and Gulf states to Texas.

*P. dentata* (fig. 30) is a reddish yellow to dark brown species differing from *P. morrisi* by the distinct and sharp propodeal spines. It differs from *P. megacephala* in not having a cordate head and differs from *P. vinelandica* by the larger size and absence of a longitudinal striation on the frontal area, and having the mesonotum transversely impressed in the middle.

#### Discussion

*P. dentata* is one of the more common species in Florida. It is easy to understand why this species caused so many misunderstandings in the past. There is much variation, not only in size and color, but also in habitat preference. I have found colonies of small dark colored specimens in wooded areas around Gainesville and large specimens that nest in sandy soil on beaches in south Florida and the Florida Keys. I also found a yellowish variant that inhabits the marshlands of the keys and another variant with quite large majors that vary in color from reddish to very dark brown nesting in open areas around Gainesville. This morphological variation seems to be without taxonomic significance.

Three mated young queens collected at Gainesville were easily reared in the laboratory. All three had majors after 50 days. The species is highly carnivorous and the colonies have a tremendous growth when fed with living arthropods. One of the colonies was inadvertently left without food and moisture for three weeks. The result was that the adults formed from the stressed broods were intermediate in size and structure between workers and majors. Some of the intermediates were not as active as the normal caste. This is a very interesting species for ecological and laboratory studies. Studies by Wilson (1975) have shown that workers of *P. dentata* use odor trails to recruit nestmates to food discoveries and new nest sites. The same pheromone is used also to recruit major workers to the vicinity of intruders. This type of alarm recruitment proved rather narrowly specific and works best against some of the potentially more important enemies of *P. dentata*, some species of the genus *Solenopsis*.

#### 6. *Pheidole dentigula* M. R. Smith

*P. dentigula* Smith, 1927. Ent. News 38:310. - Smith, 1928. Ent. News 39:245-246. - Cole, 1940. Amer. Midland Nat. 24:42, 45. - Smith, 1944. Fla. Ent. 27:14. - Creighton, 1950. Bull. Mus. Comp. Zool., 104:178. - Gregg, 1958. N.Y.



Ent. Soc. 66:21. - Wheeler and Wheeler, 1960. Ent. Soc. Wash., Proc. 62:14.

*Type locality.* Mississippi State University, Starkville, Mississippi.

*Types.* Cotypes, U.S. National Museum.

*Range.* Tennessee, southward through Alabama and Mississippi, and north Florida

*P. dentigula* (fig. 13) is a small yellowish species that differs from *P. greggi*, *P. anastasi*, *P. floridana*, *P. tysoni*, *P. bicarinata* and *P. moerens* by the reticulated, opaque occipital lobes. It differs from *P. metallescens* by having a smooth and shining propodeal base and lacks metallic reflections. The teeth on the anterior ventral border of the head are prominent.

#### Discussion

Smith (1944) reported *P. dentigula* from Wakulla County (Florida). Dr. John F. Carroll also collected this species in Marion County (Florida) on April 3, 1973. According to Smith (1944) this species nests in the soil and in well rotted stumps in wooded areas, especially where the soil contains considerable humus.

#### 7. *Pheidole diversipilosa* Wheeler

*P. crassicornis* var. *diversipilosa* Wheeler, 1908. Amer. Mus. Nat. Hist., Bul. 24:467.

*P. crassicornis* Creighton, 1950. Bull. Mus. Comp. Zool., 104:175-176.

*Type locality.* Fort Davis, Texas

*Types.* M.C.Z.

*Range.* Northwestern Florida to western Texas

*P. diversipilosa* (fig. 3) is a reddish yellow species that differs from *P. crassicornis* by the numerous erect hairs on the gaster. In *P. crassicornis tetra* the gastric hairs are nearly all of the same short length rather than obviously of mixed lengths as in *diversipilosa*.

#### Discussion

*P. diversipilosa* was collected at Tall Timbers Research Station several times where *P. crassicornis* is also present. Morphological distinction is constant between the two species. There is no real overlap in the pilosity characters. Therefore, I have treated *P. diversipilosa* as a full species on the basis that it can be sympatric with *P. crassicornis* but still retains constant morphological distinction. Creighton (1950) treated *diversipilosa* as an intergrade between *crassicornis* and *tetra*. The finding of both *crassicornis* and *diversipilosa* in the same locality in Florida invalidates Creighton's viewpoint.

Specimens of *P. crassicornis* collected in Gainesville were within the variation shown by the Tall Timbers specimens. I was unable to find specimens of *P. diversipilosa* in Gainesville. Comparison with the types and cotypes for the two taxa in the M. C. Z. and further material of *diversipilosa* collected at Columbus and Mission, Texas by W. F. Buren emphasize that we are dealing with a species group that is widely spread and contains several discrete species. *P. crassicornis* is predominantly an eastern species. *P. diversipilosa* and *P. crassicornis tetra* are

western species. Of these apparently only *P. diversipilosa* reaches east into Florida. The lack of better records for the distribution of these species probably led Creighton (1950) to synonymize *crassicornis* and *diversipilosa*. *P. crassicornis tetra* appears to be a very distinct form and may be a discrete species also, but I have not attempted taxonomic treatment in the present paper, since it does not occur in Florida.

#### 8. *Pheidole fallax obscurithorax* Santschi

*P. fallax arenicola* var. *obscurithorax* Santschi, 1923. Ann. Soc. Ent. Belg. 63:58. - Kempf, 1972. Studia Ent. 15:191.

*Type locality.* Cordoba, Argentina

*Types.* None in this country

*Range.* Probably westernmost Florida to at least Mobile, Alabama in U.S. Probably widely ranging in South America.

*P. fallax obscurithorax* (fig. 7, 8), is a large, very dark species over 6 mm in body length. Its characteristics, such as the heavily sculptured head and thick scape which is curved mesally and more angular laterally are unique among the *Pheidole* of North America.

#### Discussion

*P. fallax obscurithorax* (fig. 8) is a member of the difficult large neotropical *fallax* group which has 6 subspecies and 6 varieties. The specimens collected near the Florida border matched specimens in the M.C.Z. identified by W. W. Kempf.

This species was collected close to the Florida and Alabama border in Baldwin County, Alabama by Dr. John F. Carroll. E. O. Wilson also (personal communication) collected this species in Mobile, Alabama in 1950 within ½ mile of the ship docking area. It is apparent that this introduced species has been in the U.S. for at least 35 years but, unlike the imported fire ant, had not spread widely.

It is not a surprise to find another exotic ant species from South America in the U.S. *Brachymyrmex patagonicus* Mayr (not published), *Iridomyrmex humilis* (Mayr), *Solenopsis invicta* Buren, *S. richteri* Forel, and *Pheidole fallax obscurithorax* appear to be a group of South American ants inadvertently imported to the ports of New Orleans, and/or Mobile, and/or possibly Pensacola.

All five species have ranges along or near the Paraguay and La Plata Rivers in Western Brazil, Paraguay and Argentina. The Paraguay River is navigable by ocean going vessels up river to Asuncion, Paraguay.

#### 9. *Pheidole floridana* Emery

*P. flavens floridana* Emery, 1895. Zool. Jahrb., Abt. f. System. 8:293. - Smith, 1930. Fla. Ent. 14:3.

*P. floridana* Emery, 1895. Bull. Soc. Ent. Ital. 28:77. - Wheeler, 1932. N.Y. Ent. Soc., 40:6. - Creighton, 1950. Bull. Mus. Comp. Zool. 104:179. - Smith, 1951. Cat. Hym. Amer. No. of Mex., U.S.D.A. Mon. 2:802. - Gregg, 1958. N.Y. Ent. Soc. 66:21-22, 35. - Kempf, 1972. Studia Ent. 15:192.

*Type locality.* Coconut Grove, Florida

*Types.* M.C.Z.

*Range.* Southwest Florida

*P. floridana* (fig. 19) is a small yellowish species differing from *P. greggi* n. sp. and *P. moerens* by the distinct lateral connules on the postpetiole. It differs from *P. anastasii* by the absence of opalescence on the dorsum of the first gastric tergite.

### Discussion

*P. floridana* seems to be confined to southeast Florida in the Miami area. This is the only place where I was able to locate this species. Due to its close relationship to *P. anastasii* the latter has been misidentified as *P. floridana* many times, thus, mistakenly extending the supposed range of *P. floridana*. *P. anastasii* is actually the species widely distributed in Florida, while *floridana* is absent or at least must be rare in most of the state.

## 10. *Pheidole greggi* NEW SPECIES

*P. flavens sculptior* M. R. Smith, 1951. Cat. Hym. Amer. No. of Mex. U.S.D.A. No. 2, p. 802 (*nec* Forel).

*P. flavens* Gregg, 1958. N. Y. Entomol. Soc. 66:21 (*nec* Roger).

A small yellowish species, this is closely related to *P. flavens* Roger, *P. flavens sculptior* Forel, *P. floridana* Emery, *P. anastasii* Emery, and *P. moerens* Wheeler. Antennal scrobe weakly depressed but punctate and opaque. Frontal carinae not surpassing apices of scapes in repose. Postpetiole without lateral projections. *P. greggi* has been previously confounded with *P. flavens sculptior* and *P. flavens*.

### Description of Major

Body length 2.60 to 2.90 mm. Head length 0.82 to 0.89 mm; head width 0.79 to 0.82. Thoracic length 0.72 to 0.77 mm. Scape length 0.41 to 0.46 mm. Scape Index 52 to 56.

**Head** shape as in fig. 21; head, excluding mandibles, usually slightly longer than broad, broadest behind the eyes. The occipital lobes strongly curved and convex laterally but less curved or even angular mesally; median occipital sulcus shallow. Frontal area small and depressed; antennal scrobes weakly or not at all depressed. Clypeus with weak median carina, its anterior margin with weak median emargination. Frontal carinae short and divergent. Scapes slender at base, widening apically and usually half or more the head length; mandibles stout, each curved apically and bearing two teeth, the remaining border edentate, except for a small basal tooth. Eyes small and with approximately 23 facets.

**Thorax.** In profile, pronotum and mesonotum strongly convex and descending through an abrupt declivity to the mesopropodeal impression which is rather weakly impressed; propodeal spines small and sharp, pointed obliquely dorsad; petiole with a short anterior peduncle; anterior face of node gently sloping, the posterior face sharply declivous; crest of node convex and blunt in profile but not thickened and sub-truncate as in *anastasii* and *floridana*, ventrally the petiole straight rather than convex as in *anastasii* and *floridana*; postpetiole strongly convex dorsally, flat to slightly concave ventrally. Seen from above shoulders of pronotum well rounded.

**Abdomen.** Sides of petiole parallel; postpetiole small; the

sides convex and the shape sub-trapezoidal, without lateral connules, little wider than petiole; gaster truncate at base and slightly smaller than the head.

**Sculpture.** Head opaque, cephalic rugae sub-parallel mesally, slightly diverging laterally and reaching close to occipital lobes before disappearing; the interstitial areas between rugae with weak reticulate punctation; the occipital lobes smooth and shining; the scrobes finely reticulo-punctate; genae and areas posterior to the eyes, as well as the area anterior to the eyes longitudinally rugose, the rugae disappearing before reaching the occipital lobes, occipital lobes with fine circular piligerous punctures.

Sides of thorax, petiole and postpetiole reticulo-punctate, opaque to subopaque. Pronotal dorsum with transverse irregular striae; the interstitial areas weakly reticulo-punctate to smooth and weakly shining; mesopropodeal impression wide and with longitudinal rugulae; the interstitial areas smooth and shining; propodeal base reticulo-punctate and opaque; postpetiolar dorsum smooth and shining; gaster smooth and shining.

**Pilosity.** Erect hair yellow, pointed, numerous; both short and long hairs on head, thorax, pedicel and gaster; pubescence sparse on antennae and legs, absent on gaster.

**Color.** Concolorously yellow.

### Description of Worker

Body length 1.50 to 1.80 mm. Head length 0.46 to 0.52 mm; head width 0.43 to 0.46 mm. Thoracic length 0.41 to 0.59 mm. Scape length 0.41 to 0.43 mm. Scape Index 82 to 89.

**Head** as in fig. 45, slightly longer than broad, broadest through the eyes; posterior border of head slightly notched medially; clypeal border curved and even; clypeus with a median and 2 lateral striae; frontal area depressed and with a median longitudinal striation; frontal carinae sub-parallel; antennal scapes slender, more robust apically, reaching or surpassing the occipital border by an amount less than first funicular joint; eyes with less than 20 facets.

**Thorax.** In profile, pronotum and mesonotum strongly convex and descending sharply to the mesopropodeal impression, the latter with longitudinal rugulae. Propodeal spines sharp and pointed obliquely dorsad.

**Abdomen.** Petiole slender anteriorly. Seen from above, postpetiole sub-globular and slightly wider than the petiole.

**Sculpture.** Head reticulo-punctate; frontal area and clypeus weakly reticulo-punctate and opaque; mandibles with piligerous punctures; thorax, basal and declivous face of propodeum as well as the petiole reticulo-punctate; dorsum of postpetiole and gaster smooth and shining.

**Pilosity.** Hairs yellow, dorsal surface of head as well as the ventral surface with numerous mixed short and long erect and semi-erect hairs; dorsum of thorax with predominantly long erect hairs; pedicel and gaster with long semi-erect numerous hairs.

**Color.** Concolorously yellow.

### Female and Male

Unknown.

**Holotype.** Major (collected on December 19, 1945 in

Miami, Florida by W. F. Buren).

*Paratypes.* 39 majors, 26 workers.

### Discussion

The type material comprises 23 majors and 16 workers, collected on December 19, 1945 in Miami, Florida, by W. F. Buren; 6 majors and 6 workers collected in 1975 in Baldwin County, Florida by D. P. Wojcik; 10 majors and 8 workers collected on November 25, 1975, in Naples, Florida by M. A. Naves.

The holotype and several paratypes are deposited at the Florida State Collection of Arthropods, Division of Plant Industry, Gainesville, Florida; and the M. A. Naves collection. The species is named in honor of Dr. Robert E. Gregg, Professor of Entomology, University of Colorado.

Gregg (1958) expended a great deal of effort trying to identify a sample of this species that he and Mrs. Gregg collected in Brickell Hammock, Miami, Florida. In his own words:

The specimens of *sculptor* from Miami, Florida (Buren det.) and the sample obtained from Brickell Hammock are indistinguishable. Despite the similarities of the scrobes and their sculpture, these ants are not identical, however, with the examples of *sculptor* from Puerto Rico and Martinique, nor with the types from St. Vincent. This is evident especially from the smooth (almost sculptureless) and shining occipital lobes of the Florida ants. In *sculptor*, the cephalic rugae and punctures completely cover the head, making it opaque, except at the extreme posterior margin around the foramen which is smooth and shining. In addition, the epinotal spines of the Brickell Hammock ants are longer and sharper than those of *sculptor*. These two samples of the *flavens* group in Florida cannot represent *P. flavens sculptor* (from the West Indies), and unless this subspecies is known from Florida by other specimens, or is there but not yet collected, this discovery requires a revision of the North American list. *Pheidole flavens sculptor* must be dropped, and that is the plan followed in this paper (p. 45).

Fig. 21 shows the head of *P. greggi* from the original specimens collected at Miami, Florida, by W. F. Buren. This confirms Gregg's conclusion that they are not conspecific with *sculptor*. The occipital lobes of *P. flavens sculptor* from St. Thomas, Virgin Islands, also collected by Buren on January 18, 1952, are shown in fig. 56.

The specimens collected at Naples were from a colony at the base of a telephone pole on sandy soil close to the beach. The colony was quite sizeable as in *P. anastasioi*, *P. floridana* and *P. moerens*.

Although Gregg showed that Buren's original identification of *sculptor* from Florida specimens was in error, and that apparently *sculptor* does not occur in the U.S., he left unresolved the question of what name should be applied to the Florida species. The present studies indicate that it is a new, undescribed species distinct from *P. flavens* Roger (fig. 55), *P. flavens sculptor* Forel, *P. floridana* Emery, *P. anastasioi* Emery and *P. moerens* Wheeler.

Much more study is needed in order to fully understand this difficult group which has several related species, 8 subspecies

and 13 varieties in the new world.

This new species differs from *P. anastasioi* and *P. floridana* by the shape of the postpetiole which is slightly larger than the petiole and does not have the distinct lateral connules. It differs from *P. flavens* by having the scrobe heavily reticulo-punctate, and the vertex not smooth and shining. It differs from *P. flavens sculptor* by having smooth and shining occipital lobes. It also differs from *P. moerens* by having a reticulo-punctate scrobe, which is opaque as well as the entire head.

### 11. *Pheidole lamia* Wheeler

*P. lamia* Wheeler, 1901. Amer. Nat. 35:534. - Wheeler, 1908. Amer. Mus. Nat. Hist., Bul. 24:477-478. - Wheeler, 1910. Ants, pp. 212, 248. - Wheeler, 1926. Ants, pp. 212, 248. - Smith, 1931. Ent. News 42:21-22. Creighton, 1950. Bull. Mus. Comp. Zool. 104:182. - Smith, 1951. Cat. Hym. Amer. No. of Mex. U.S.D.A. Mon 2:803. - Gregg, 1956. Ent. News 67:37-39. - Gregg, 1958. N.Y. Ent. Soc. 66:23.

*Type locality.* Austin, Texas

*Types.* M.C.Z., A.M.N.H.

*Range.* North Florida to Texas

*P. lamia* is a small, yellowish, shining species with a subcylindrical head in the major which is truncate anteriorly. The soldier of *P. lamia* has the most striking head shape in the genus.

### Discussion

The head shape of *P. lamia* led Wheeler (1908) to suggest that it was a phragmotic ant. He also believed it to be a very rare species. Buren *et al.* (In Press), showed by laboratory and field observations that phragmosis does not occur in this species.

At Tall Timbers Research Station where this species is common, I had the opportunity to observe the biology of this interesting species. Colonies are monogynous and sometimes have up to about 200 majors and 1,000 workers. The nests are in the ground, usually in grassy areas as well as among taller vegetation. The nesting sites, at least at Tall Timbers, can be easily spotted in the morning due to the reddish clay soil cast up in very small honey-combed hillocks. These clumps consist of fine soil particles and can have several openings connected to a vertical tunnel of about 2 mm in diameter. From the vertical tunnel branch single secondary galleries each directly connected to an oval chamber of about 0.5 to 1.5 cm in height and about 4 to 6 cm in length. Each colony has several chambers. The first is found usually over 40 cm deep. I have dug over 1.5 m deep following the main tunnel without reaching the end of it in four colonies. In the summer of 1973, I found the first female after digging seven colonies. In July, 1974, I found about thirty males in tunnels close to the soil surface. In July, 1975, I found 18 females inside a large chamber of about 50 cm deep. One mating pair that fell on the ground was collected in the late afternoon on July 15, 1974. The soil where this species nests usually has the first 30 cm predominantly sandy. Deeper there is a reddish clay where this species has its chambers.

This species usually forages in the morning or when there is no sunlight. Majors sometimes are found among debris with the workers. The pale yellow color of this species also could

indicate that this species is nocturnal. The workers were observed carrying small seeds, small insects and mites to the nest. Some majors in the chambers might be repletes since they have quite extended gasters full of liquid. Buren *et al.* (In Press) show that this species has stylized defenses against *Solenopsis* (*Diplorhoptrum*) spp.

## 12. *Pheidole littoralis* Cole

*P. sitarches littoralis* Cole, 1952. Ann. Ent. Soc. Amer. 45:443. - Gregg, 1958. N.Y. Ent. Soc. 66:30-39.

*Type locality.* Lido Beach, Sarasota, Florida

*Type.* A. C. collection; M.C.Z.; U.S.N.M., A.M.N.H. and W. S. Creighton collection. Both the A. C. Cole collection and W. S. Creighton collection are now at the Los Angeles County Museum of Natural History.

*Range.* Central Florida

*P. littoralis* (fig. 20) has a reddish brown head and thorax, the gaster black and shining. It differs from *P. sitarches*, *P. sitarches compestris* and *P. sitarches soritis* by the presence of deep, large piligerous foveolae on the occipital lobes which also have no distinct transverse striae.

### Discussion

*P. littoralis* is a distinct species related to the *sitarches* complex as Cole (1952) suggested. This species was collected nesting in white sand at the Archbold Biological Research Station, where it is very common. It was found nesting side by side with *P. metallescens* and *P. adrianoi* n. sp. The colonies seem to be quite small. Digging to 50 cm deep failed to produce any brood chamber or any sexual forms. At about 10 to 20 cm deep there was always a chamber full with small grass seeds and never more than four majors. The major has a large head which is disproportional considering the small size of the rest of the body. Majors were never observed outside the nest foraging. The small black, shining workers can easily be confounded with *P. metallescens* and *P. adrianoi* n. sp. workers.

## 13. *Pheidole megacephala* (Fabricius)

*Formica megacephala* Fabricius, 1793. Ent. Syst. 2:361.

*P. megacephala* Emery 1921. Gen. Insect. Fasc. 174, p. 85. - Phillips 1934. (Hawaii Univ.) Expt. Sta. Pineapple Prod. Coop. Assoc. Bul. 15:5-12. - Smith, 1936. Puerto Rico Univ., Jour. Agr. 20:843-844. - Broekhuysen, 1948. Union So. Africa Dept. Agr. Bul. 266:1-40. - Smith, 1951. Cat. Hym. Am. No. of Mex. U.S.D.A. Mon 2:803. - Wheeler and Wheeler, 1953. Ent. Soc. Wash., Proc. 55:75. - Brown, 1958. Act. Hym. 1:47. - Gregg, 1958. N.Y. Ent. Soc. 66:23. - Brown, 1959. Bul. Ent. Res. 50:523. - Weber, 1960. Ent. Soc. Wash., Proc. 62:232. - Taylor and Wilson, 1961. Psyche 68:143. - Kempf, 1962. Studia Ent. 5:18-19. - Haskins and Haskins, 1965. Ecology of 46:737. - Wilson and Taylor, 1967. Pacific. Insects Monog. 14:46-48. - Fluker, Huddleston, and Beardsley, 1968. Jour. Econ. Ent. 61:474. - Fluker and Beardsley, 1970. Ent. Soc. Amer., Ann. 63:1290-1296. - Kempf, 1972. Studia Ent. 15:196.

*Oecophthora pusilla* Heer, 1852. Stueck 66:15. - Wheeler,

1922. Bull. Amer. Mus. Nat. Hist. 45:812.

*P. laevigata* Mayr, 1862. Verli. Zool. - Bot. Ges. Wien 12:747. - Mayr, 1870. Vehr. Zool. - Bot. Ges. Wien 20:981.

*Type locality.* Isle de France (Mauritius)

*Type.* None in this country.

*Range.* This species has become a world tramp; in Florida it apparently is largely confined to South Florida.

*P. megacephala* (fig. 9), is a dark yellow to brownish-ferruginous species that differs from *P. morrisi* by having distinct and sharp propodeal spines. It also differs from *P. morrisi* and *P. dentata* by having a cordate head narrowing toward the mandibular insertion and the mesonotum is not distinctly transversely impressed.

### Discussion

*P. megacephala* is a well known world tramp (Gregg, 1958). It has been present in Florida for 43 years, at least, being reported by Smith (1933) from Everglades, Key West and St. Augustine. I collected this species in downtown Homestead, Florida on November 25, 1975 nesting under a paved sidewalk and at Archbold Biological Research Station. Buren observed large colonies of this species trailing in large numbers from the colony to nearby trees (Personal Communication). Its ecological impact has been studied in relation to another world tramp, *Iridomyrmex humilis*. Flucker *et al.* (1970) reported *P. megacephala* was losing territory to *I. humilis* in Hawaii, although it did not appear to be even remotely approaching extermination. They also found that *P. megacephala* did not seem to occupy territory above 915 m, above which *I. humilis* was usually found. Dieberburg *et al.* (1975) reported that in a 7-year period *P. megacephala* did not loose much territory to *I. humilis* in Bermuda. He also reported that *P. megacephala* prefers clumped food sources and *I. humilis* preferred dispersed food sources. Based on these findings they suggested that an equilibrium between the two species was possible in Bermuda. Brown (1973) suggested that *P. megacephala* was a mortal enemy of *I. humilis* and that the latter was vanquishing *P. megacephala* outside the tropics.

In Florida the two species seem to occupy two distinct areas. *I. humilis*, although not common, occurs in the northernmost and northwest areas of the state. *P. megacephala*, also not common, occurs in the southern area of the state. In the central area of the state I was able to find only *P. megacephala*. At least in Florida the two species are not sympatric and the inability of either of them to increase must be due to some other cause, possibly competition with *Solenopsis invicta* Buren or *Solenopsis geminata* (Fabricius).

## 14. *Pheidole metallescens* Emery

*P. metallescens* Emery, 1895. Zool. Jahrb., Abst. of System. 8:289, 294. - Wheeler, 1908. Amer. Mus. Nat. Hist., Bul. 24:476-477. - Smith, 1930. Fla. Ent. 14:3. - Wheeler, 1932. N.Y. Ent. Soc. 40:7. - Creighton, 1950. Bull. Mus. Comp. Zool. 104:183. - Smith, 1951. Cat. Hym. Am. No. of Mex., U.S.D.A. Mon 2:803. - Gregg, 1958. N.Y. Ent. Soc. 66:23. - Wheeler and Wheeler, 1960. Ent. Soc. Wash., Proc. 62:12.

*Type locality.* St. George, Florida

*Types.* None in this country

*Range.* Gulf States

*P. metallescens* (fig. 16) is a small species usually with reddish brown head and thorax and black gaster, although completely dark to black specimens have been found. It differs from *P. greggi* n. sp. and *P. moerens* by the distinct lateral connules on the postpetiole. It also differs from *P. floridana* and *P. anastasii* by the strong reticulation posteriorly on the head and from *P. dentigula* by having a reticulo-punctate propodeal base. The workers display strong, metallic, iridescent bluish reflections over most of the body.

#### Discussion

*P. metallescens* is very common in Florida. The preferable habitat seems to be under the shade of trees or any high vegetation. Usually it is easy to find several small craters connected to a central vertical tunnel to the main chamber, rarely over 40 cm deep in the ground. It is a monogynous species. The majors usually forage along with the workers. They feed on small grass seeds and also scavenge dead arthropods.

#### 15. *Pheidole moerens* Wheeler

*P. moerens* Wheeler, 1908. Bull. Amer. Mus. Nat. Hist. 24:136. - Smith, 1936. Puerto Rico Univ., Jour. Agr. 20:842-843. - Smith, 1967. Cat. Hym. Amer. No. of Mex. U.S.D.A. Mon 2 (Suppl. 2):354. - Wheeler and Wheeler, 1972. Ga. Ent. Soc., Jour. 7:244. - Kempf, 1972. Studia Ent. 15:196. - Wojcik, Banks, and Buren, 1975. Coop. Econ. Ins. Rpt. U.S.D.A. 25:906.

*P. moerens dominicensis* Wheeler, 1913. Bull. Amer. Mus. Nat. Hist. 32:241. - Kempf, 1972. Studia Ent. 15:197. NEW SYNONYMY.

*Type locality.* Antilha Culebra

*Types.* M.C.Z.

*Range.* Southern Alabama, Florida, West Indies

*P. moerens* (fig. 22) is a small reddish yellow to almost black species closely related to *P. greggi* n. sp., differing from it by the absence of the heavily punctate scrobe and in having a carinated shining clypeus. It differs from *P. dentigula*, *P. anastasii*, *P. floridana* and *P. metallescens* by the absence of distinct lateral connules on the postpetiole.

#### Discussion

*P. moerens* is a common species in north Florida. Its color was observed in lab colonies to vary from reddish yellow to almost black due possibly to variation in the diet. Colonies fed with honey and seeds retained a lighter color than those fed with freshly killed house flies. Wheeler's subspecies *dominicensis* appears to represent only a color variant often found among the normal population. I have examined the types of *dominicensis* and they appear identical with the types of *moerens* except in color. I do not consider *dominicensis* a valid taxon.

This species was found nesting in various places such as under boards, at base of oak trees and fence posts, along roots, under palm leaves, inside wall crevices, and rarely in the ground. Usually small chambers are constructed. It is a monogynous

species which has a small blackish female. Its main flight is usually in July. Several queens may start founding a nest, but before the first brood emerges, the dominant female will have killed the others.

The chambers usually are built with small soil or debris particles and have small openings. A colony may have over 100 majors and over 500 workers. They feed on seeds and scavenge and prey on small dead or live arthropods. They forage very close to the nesting sites and sometimes a major is found foraging along with the workers.

#### 16. *Pheidole morrisi* Forel

*P. morrisi* Forel, 1886. Soc. Ent. Belg., Bul. 30:46. - Mayr, 1887. Verh. Zool. - Bot. Ges. Wien 37:568. - Forel, 1901. Soc. Ent. Belg., Ann. 45:350. - Wheeler, 1904. Amer. Mus. Nat. Hist., Bul. 21:380. - Wheeler, 1908. Amer. Mus. Nat. Hist., Bul. 24:461. - Smith, 1918. Ent. News 29:21. Davis and Bequaert, 1922. Brooklyn Ent. Soc., Bul. 17:8-9. - Smith, 1924. Ent. News 35:53. - Smith, 1930. Fla. Ent. 14:3. - Wheeler, 1932. N.Y. Ent. Soc. 40:7. - Cole, 1940. Amer. Midland Nat. 24:44-45. - Creighton, 1950. Bull. Mus. Comp. Zool. 104:183-184. - Smith, 1951. Cat. Hym. Amer. No. of Mex., U.S.D.A. Mon 2:803. - Gregg, 1958. N.Y. Ent. Soc. 66:24. - Wheeler and Wheeler, 1960. Ent. Soc. Amer., Ann. 53:12.

*P. morrisi* var. *vancea* Forel, 1901. Soc. Ent. Belg., Ann. 45:351. - Wheeler, 1904. Amer. Mus. Nat. Hist., Bul. 20:302. Wheeler, 1908. Amer. Mus. Nat. Hist., Bul. 24:461. - Smith, 1924. Ent. News 35:53. - Smith, 1951. Cat. Hym. Amer. No. of Mex., U.S.D.A. Mon. 2:803-804.

*Type locality.* Vineland, New Jersey

*Types.* None in this country

*Range.* Southern New Jersey, south to Florida and eastern Gulf states.

*P. morrisi* (fig. 27) is a pale to darker yellowish species differing from *P. dentata* and *P. vinelandica* by the absence of distinct propodeal teeth or spines. It is larger than *P. vinelandica* and has a transverse mesonotal impression.

#### Discussion

*P. morrisi* is another common species in Florida. It always nests in the ground and the colonies are quite large. It is a monogynous species and is primarily a scavenger.

Several nest founding females displayed singular habits in the laboratory which may not have been noted previously in this genus. In constructing the claustral chamber each female used the soil dug from the bottom of the vertical passageway to form a continuous plug of the passageway above her rather than bringing the soil particles to the surface. The claustral chamber at the 20 to 30 cm level below ground thus is entirely sealed from the surface by a long plug. I interpret this habit as a defense mechanism against various predators during the claustral period. The first workers are reared in about 30 days and the first majors in about 50 days.

The colony increases in size rapidly. In 8 months it can have several hundred workers and majors. The workers forage alone, although the majors can help to bring food back to the

colony once food is located. Workers can forage over 8 m from the nesting site. The species is mainly a scavenger but will also gather seeds.

### 17. *Pheidole tysoni* Forel

*P. tysoni* Forel, 1901. Soc. Ent. Belg., Ann. 45:348. - Wheeler, 1904. Amer. Mus. Nat. Hist. 20:302. - Smith, 1918. Ent. News 29:22. - Smith, 1924. Ent. News 35:78. - Dennis, 1938. Ent. Soc. Amer. 31:282, 304. - Wesson and Wesson, 1940. Amer. Midland Nat. 24:92. - Cole, 1940. Amer. Midland Nat. 24:42, 45. - Creighton, 1950. Bull. Mus. Comp. Zool. 104:191. - Smith, 1951. Cat. Hym. Amer. No. of Mex., U.S.D.A. Mon. 2:805. - Gregg, 1958. N.Y. Ent. Soc. 66:32.

*Type locality.* Mt. Mitchell, North Carolina

*Types.* A.M.N.H., M.C.Z.

*Range.* North Florida, Georgia, western North Carolina, southwestern Virginia and eastern Tennessee.

*P. tysoni* is a small yellowish species closely related to *P. vinelandica*, differing from it by the teeth on the anterior ventral margin of head. The minor has the propodeal pleurae largely free from sculpture and strongly shining.

#### Discussion

*P. tysoni* was collected once in a soybean field at Tall Timbers Research Station in 1973. The colony was quite large and the main chamber was about 50 cm deep in the ground. Only minors were foraging. This is the only record known for the state and I am assuming that *P. tysoni* is rare in Florida.

### 18. *Pheidole vinelandica* Forel

*P. bicarinata* race *vinelandica* Forel, 1886. Ann. Soc. Ent. Belg. 30:45.

*P. vinelandica* Mayr, 1886. Verh. Zool.-Bot. Ges. Wien 36:458. - Emery, 1895. Zool. Jahrb. Syst. 8:292. - Forel, 1901. Ann. Soc. Ent. Belg. 45:348. - Wheeler, 1904. Amer. Mus. Nat. Hist., Bul. 24:458. - Smith, 1918. Ent. News 29:22. - Davis and Bequaert, 1922. Brook. Ent. Soc. 17:9. - Smith, 1924. Ent. News, 35:54. - Hayer, 1925. Ent. News 36:42. - Cole, 1940. Amer. Midland Nat. 24:42. - Wesson and Wesson, 1940. Amer. Midland Nat. 24:92-93.

*P. (Allophidole) vinelandica* Forel, 1912 - Mem. Soc. Ent. Belg. 19:237.

*P. vinelandica laeviuscula* Emery, 1895. Zool. Jahrb. Syst. 8:292. - Smith, 1951. Cat. Hym. Amer. No. of Mex. U.S.D.A. Mon. 2:805.

*P. vinelandica* subsp. *buccalis* Wheeler, 1908. Bull. Amer. Mus. Nat. Hist. 24:454. - Smith, 1951. Cat. Hym. Amer. No. of Mex. U.S.D.A. Mon. 2:805.

*P. vinelandica longula* var. *castanea*. Wheeler, 1915. Amer. Mus. Nat. Hist. 34:405. - Cole, 1937. Ent. News. 48:100.

*P. bicarinata buccalis* Creighton, 1950. Bull. Mus. Comp. Zool. 104:171. - Cole, 1953. Tenn. Ac. Sc. 28:297.

*P. bicarinata vinelandica* Creighton, 1950. Bull. Mus. Comp. Zool. 104:17a. - Cole, 1956. Tenn. Acad. Sc. 31:114. - Gregg, 1958. N.Y. Ent. Soc. 66:18, 36. - Reid and Nugara, 1961. Jour. Parasitology 47:885-889. - Smith, 1965. U.S.

Dept. Agr., Tech. Bul. 1326:25-26.

*P. vinelandica vinelandica*. Smith, 1951. Cat. Hym. Amer. No. of Mex. U.S.D.A. Mon. 2:806.

*Type locality.* Vineland, New Jersey

*Types.* Cotypes, A.M.N.H.

*Range.* Southeastern and Gulf States and along the east coast to New Jersey.

*P. vinelandica* is a small yellowish species differing from *P. bicarinata* by having the basal face of propodeum in the major largely punctate (fig. 60) and having a longitudinal striation on the frontal area (fig. 63). It differs from *P. tysoni* by the absence of teeth on the anterior ventral margin of the head.

#### Discussion

I had the opportunity to study specimens of *P. vinelandica* from New Jersey, North Carolina, South Carolina, Georgia, Alabama, and Texas. I have also collected this species at Tall Timbers Research Station as well as in Putnam Co., Florida. I have compared these with specimens of *P. bicarinata* (fig. 24, 61, 62) from Illinois in the M.C.Z. I also have studied specimens of *bicarinata* collected at Colorado Springs, Colorado; Ames and Lewis, Iowa; Devils Tower, Wyoming; Ortonville, Minnesota, and Corinne, Utah. It was evident that the two forms are not conspecific and have constant morphological differences, emphasizing that *P. vinelandica* deserves full species rank. Gregg (1958) included the var. *nebrascensis* Forel and the var. *huachucana* Smith as synonymus of *vinelandica*. I have not studied the types of these taxa but am doubtful about their inclusion under *vinelandica* rather than *bicarinata*. Records of *vinelandica* from North Dakota and Colorado also seem doubtful, and seem much more likely to be misdetermined records of *bicarinata*.

*P. vinelandica* is found nesting in grassy areas at Tall Timbers Research Station. The minors and majors are easily seen foraging close to the nesting site. The nest has several exits. They were observed carrying seeds and small dead arthropods.

### SPECIES NOT PROPERLY INCLUDED IN THE FLORIDA PHEIDOLE FAUNA

#### 19. *Pheidole pilifera* (Roger)

*Leptothorax pilifera* Roger, 1863. Berl. Ent. Zeitschr., 7:180.

*P. pilifera* var. *simulans* Wheeler, 1908. Bull. Amer. Mus. Nat. Hist., 24:436.

*P. pilifera* subsp. *septentrionalis* Wheeler, 1908. Bull. Amer. Mus. Nat. Hist. 24:436.

*P. pennsylvanica* Roger, 1863. Berl. Ent. Zeitschr., 7:199. - Mayr, 1870. Verh. Zool.-Bot. Ges. Wien, 20:981. - Mayr, 1886. Verh. Zool.-Bot. Ges. Wien, 36:455. - Mayr, 1877. Verh. Zool.-Bot. Ges. Wien, 37:588.

*P. pilifera* Emery, 1895. Zool. Jahrb. Syst. 8:290. - Creighton, 1950. Bull. Mus. Comp. Zool. 104:184-186. - Van Pelt, 1956. Amer. Midland Nat. 56:377, 834. - Smith, 1958. Cat. Hym. Amer. No. of Mex., U.S.D.A. Mon. 2 (Suppl. 1):123. - Gregg, 1958. N.Y. Ent. Soc., 66:24-25.

*Type locality.* Pennsylvania

*Types.* None in this country

*Range.* Massachusetts to North Carolina and West to Iowa and Nebraska

*P. pilifera* differs from *P. carrolli* n. sp. and *P. littoralis* Cole by having the occipital rugae of the major notably reticulate and often coarse; its occipital lobes are not well rounded and pronounced.

### Discussion

Attempts were made by the author to find *P. pilifera* in Florida as reported by Van Pelt (1956). Dr. Van Pelt, however, expressed some reservations about the correctness of this identification. No voucher specimens of *P. pilifera* are presently available from Dr. Van Pelt's work. Although it seems possible that *P. pilifera* occurs in Florida, I am unconvinced that there is any direct evidence. I believe all reported specimens were probably *P. carrolli* n. sp., *P. littoralis* Cole, or other species.

### ABSTRACT

Until recently only twelve species of *Pheidole* were reported from Florida: *P. anastasioi* Emery, *P. bicarinata vinelandica* Forel, *P. dentigula* M. R. Smith, *P. flavens* Roger, *P. megacephala* (Fabricius), *P. moerens* Wheeler, *P. morrisoni* Forel, *P. pilifera* (Roger), *P. dentata* Mayr, *P. floridana* Emery, *P. metallescens* Emery and *P. sitarches littoralis* Cole. The last four have Florida as the type locality.

*P. pilifera* (Roger) is believed to have been erroneously reported from Florida and has been excluded from the Florida fauna. *P. flavens* (Gregg, 1958, nec Roger) is considered a misidentification and to be an undescribed species, *P. greggi* n. sp.

In addition to *P. greggi* n. sp., 2 additional new species of *Pheidole* are described from Florida: *P. adrianoi* n. sp., *P. carrolli* n. sp. An exotic species, *P. fallax obscurithorax* (= *P. fallax arenicola* var. *obscurithorax* Santschi) probably introduced from South America, is also added to the North American ant fauna.

*Pheidole crassicornis* Emery and *P. diversipilosa* Wheeler are recorded for the first time in Florida. The latter species is resurrected from synonymy and is elevated to full species.

Two additional taxa are elevated to full species: *P. vinelandica* (= *P. bicarinata vinelandica* Forel) and *P. littoralis* (= *P. sitarches littoralis* Cole).

The two new species, *P. adrianoi* n. sp., *P. carrolli* n. sp., plus the introduced species *P. fallax obscurithorax* Santschi and the recognized species *P. diversipilosa* Wheeler increase the total *Pheidole* fauna of North America north of Mexico to seventy-five. The Florida *Pheidole* fauna is increased to eighteen species and *Pheidole* is now the largest ant genus in the state.

Keys for the identification of both majors and workers are provided. Scanning electron micrographs are also provided as identification aides. The ecological behavior and biology of each species is discussed.

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### LITERATURE CITED

- Brown, W. L. 1973. A comparison of the Hylean and Congo-West African rain forest ant faunas, p. 161-185. In B. J. Meggers, E. S. Ayensu, and W. D. Duckworth (ed.). Tropical forest ecosystems in Africa and South America: A comparative review. Smithsonian Institution Press, Washington, D.C.
- Buren, W. F. 1942. New ants from Minnesota, Iowa, and Wisconsin. Iowa State College Jour. Sci. 16:399-40.
- Buren, W. F. 1944. A list of Iowa ants. Iowa State College Jour. Sci. 18:277-312.
- Buren, W. F., M. A. Naves, and T. Carlisle. False phragmosis and apparent specialization for subterranean warfare in *Pheidole lamia* Wheeler (Hymenoptera: Formicidae). In press.
- Cole, A. C. 1952. A new *Pheidole* (Hymenoptera: Formicidae) from Florida. Ann. Ent. Soc. Amer. 45:443-444.
- Creighton, W. S. 1950. The ants of North America. Bull. Mus. Comp. Zool., Harvard, 104:1-585.
- Emery, C., 1895. Beitrage zur Kenntnis der nordamerikanischen Ameisenfauna. II. Zool. Jahrb. Syst. 8:257-360.
- Fluker, S. S., and J. W. Beardsley, 1970. Sympatric associations of three ants: *Iridomyrmex humilis*, *Pheidole megacephala*, and *Anoplolepis longipes* in Hawaii. Ent. Soc. Amer., Ann. 63:1290-1296.
- Gregg, R. E. 1958. Key to the species of *Pheidole* (Hymenoptera: Formicidae) in the United States. Jour. New York Ent. Soc., 66:7-48.
- Gregg, R. E. 1969. New species of *Pheidole* from Pacific Coast Islands (Hymenoptera: Formicidae) Ent. News 80:93-101.
- Kempf, W. W. 1972. Catalogo abreviado das Formigas da Regiao Neotropical (Hymenoptera: Formicidae). Studia Ent. 15:3-344.
- King, R. L. 1949. Mixed colonies in ants. Iowa Acad. Sci. 56:367-370.
- King, R. L., and R. M. Sallee. 1951. More mixed colonies in ants. Iowa Acad. Sci. 58:487-489.
- Liebergurg, I., P. M. Krans, and A. Seip. 1975. Bermudian ants



- revisited. The status and interaction of *Pheidole megacephala* and *Iridomyrmex humilis*. Ecology. 56:473-478.
- Mayr, G. L. 1886. Die Formicidin Der Vereinigten Staaten Von Nordamerica Verhandlungen Der. Zool-Bot. Gesell. Wein, Verh. 36:419-464.
- Smith, M. R. 1930. A list of Florida ants. Florida Ent. 14:1-6.
- Smith, M. R. 1933. Additional species of Florida ants, with remarks. Florida Ent. 17:21-26.
- Smith, M. R. 1941. The discovery of the worker caste of an inquiline ant, *Epipheidole inquilina* Wheeler. Proc. Ent. Soc. Washington 24:104-109.
- Smith, M. R. 1944. Additional ants recorded from Florida, with descriptions of two new subspecies. Florida Ent. 27:14-17.
- Smith, M. R. 1951. Formicidae. In K. V. Krombein and B. D. Burks, eds., Hymenoptera of America North of Mexico, Synoptic Catalog, U.S.D.A., Agr. Mon. 2:799-806.
- Smith, M. R. 1958. Formicidae. In K. V. Krombein and B. D. Burks, eds., Hymenoptera of America North of Mexico, Synoptic Catalog, U.S.D.A., Agr. Mon. 2(Suppl. 2):343-474.
- Van Pelt, A. F., Jr. 1956. The ecology of the ants of the Welaka Reserve, Florida (Hymenoptera: Formicidae). American Midl. Nat. 56:387.
- Wheeler, W. M. 1904. Three new genera of inquiline ants from Utah and Colorado. Bull. American Mus. Nat. Hist. 20:1-17.
- Wheeler, W. M. 1910. Ants, their structure, development and behavior, Columbia University Press, 663 pp.
- Wheeler, W. M. 1932. A list of the ants of Florida with descriptions of new forms. Jour. New York Ent. Soc. 40:1-171.
- Wilson, E. O. 1975. Enemy specification in the alarm-recruitment system of the ant. Science 190:798-800.
- Wojcik, D. P., W. A. Banks and W. F. Buren, 1975. First report of *Pheidole moerens* in Florida (Hymenoptera: Formicidae) U.S.D.A. Coop. Econ. Ins. Rpt. 25(49-52):906.

## PLATE 1

Figure 1. Head of major of *P. lamia* Wheeler (33x)

Figure 2. Scape of a major of the *P. crassicornia* complex (81x)

Figure 3. Head of major of *P. diversipilosa* Wheeler (45x)

Figure 4. Gaster of major of *P. diversipilosa* Wheeler (47x)

Figure 5. Head of major of *P. crassicornis* Emery (43x)

Figure 6. Gaster of major of *P. crassicornis* Emery (58x)



## PLATE 2

Figure 7. Scape of major of *P. fallax obscurithorax* Santschi (81x)

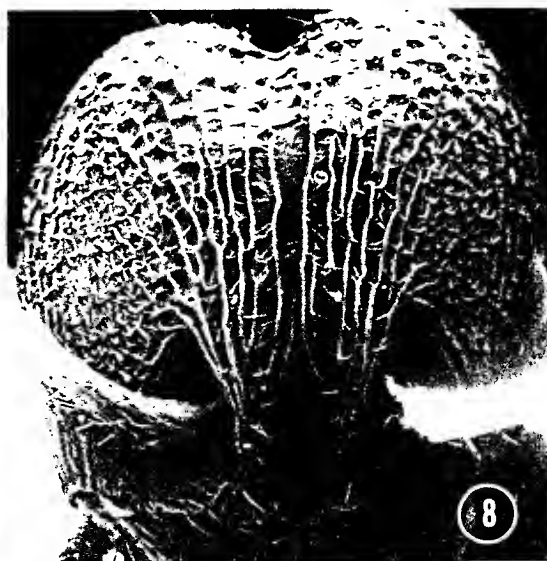
Figure 8. Head of major of *P. fallax obscurithorax* Santschi (81x)

Figure 9. Head of major of *P. megacephala* (Fabricius) (40x)

Figure 10. Pedicel of major of *P. floridana* Emery (128x)

Figure 11. Propodeum, pedicel and gaster of major of *P. metallescens* Emery (74x)

Figure 12. Postpetiole of major of *P. littoralis* Cole (119x)



## PLATE 3

Figure 13. Head of major of *P. dentigula* M. R. Smith (64x)

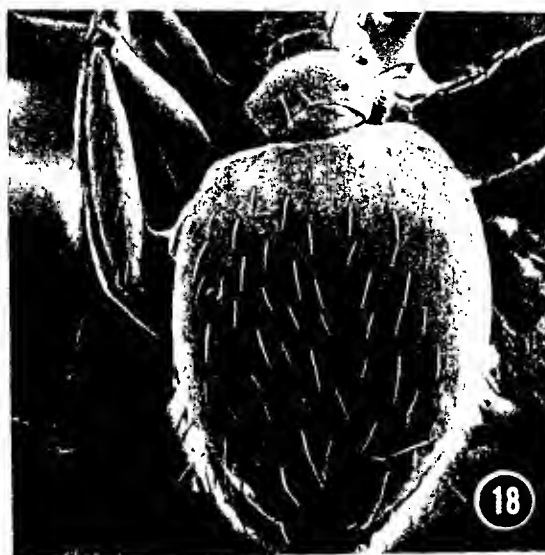
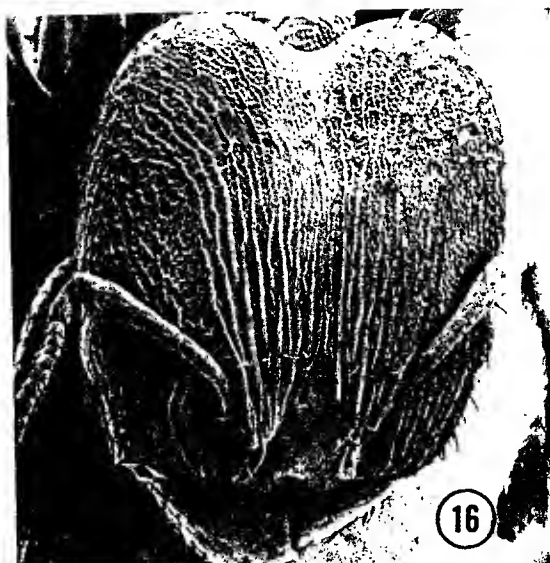
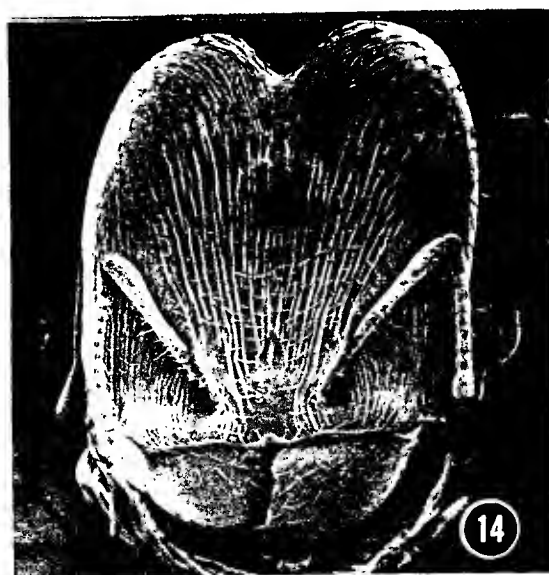
Figure 14. Head of major of *P. carrolli* n. sp. (29x)

Figure 15. Pedicel of major of *P. metallescens* Emery (163x)

Figure 16. Head of major of *P. metallescens* Emery (68x)

Figure 17. Head of major of *P. anastasii* Emery (68x)

Figure 18. Postpetiole and gaster of *P. anastasii* Emery (62x)



## PLATE 4

Figure 19. Head of major of *P. floridana* Emery (72x)

Figure 20. Head of major of *P. littoralis* Cole (37x)

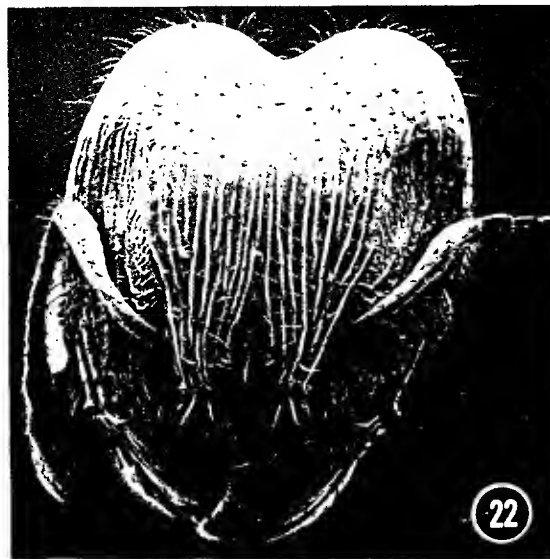
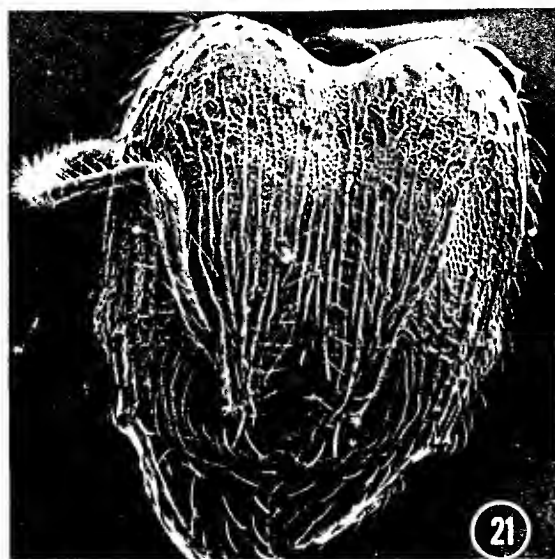
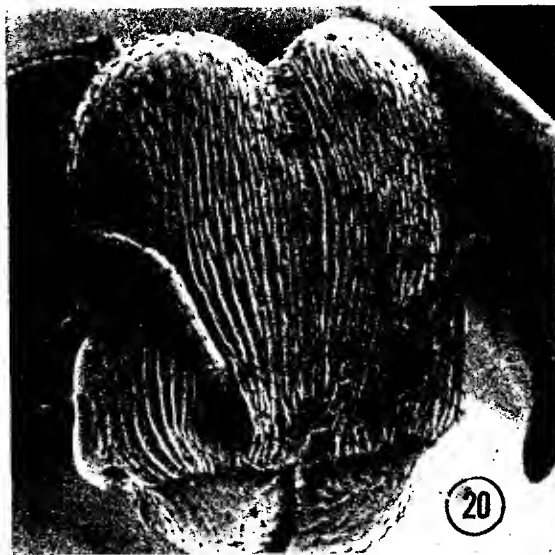
Figure 21. Head of major of *P. greggi* n. sp. (68x)

Figure 22. Head of major of *P. moerens* Wheeler (58x)

Figure 23. Clypeus and frontal area of major of *P. vinelandica* Forel (186x)

Figure 24. Head of major of *P. bicarinata* Mayr (53x)





## PLATE 5

Figure 25. Head of major *P. adrianoi* n. sp. (72x)

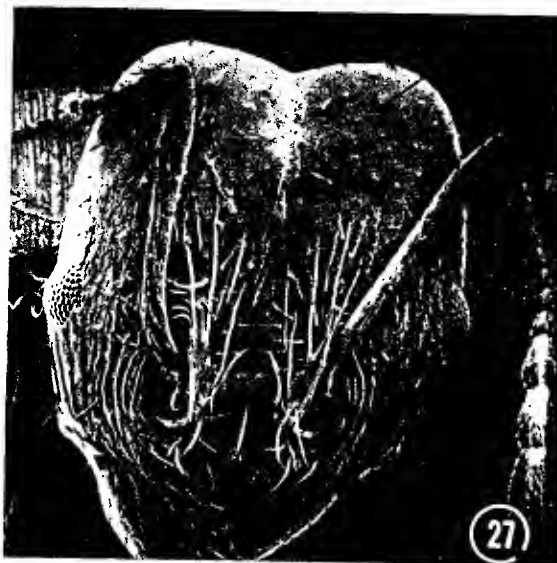
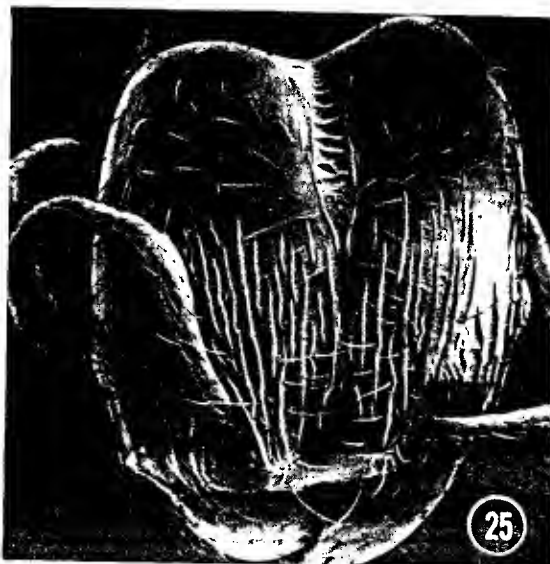
Figure 26. Thorax, pedicel, and gaster of major of *P. adrianoi* n. sp. (50x);  
white legs are artifacts due to electron overcharge.

Figure 27. Head of major of *P. morrisi* Forel (37x)

Figure 28. Thorax of major of *P. morrisi* Forel (56x)

Figure 29. Head of major of *P. dentata* Mayr (48x)

Figure 30. Teeth on the anterior ventral head margin of *P. anastasioi* Emery  
(123x)



## PLATE 6

Figure 31. Head of worker of *P. lamia* Wheeler (97x)

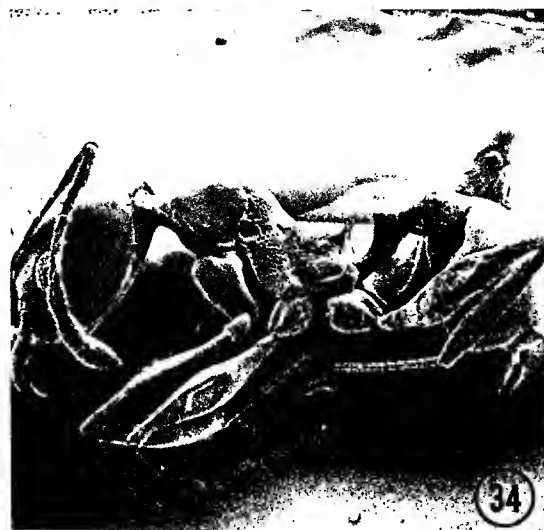
Figure 32. Dorsal view of worker of *P. vinelandica* Forel (62x)

Figure 33. Dorsal view of worker of *P. adrianoi* n. sp. (95x)

Figure 34. Worker of *P. megacephala* (Fabricius) (36x)

Figure 35. Thorax and pedicel of the worker of *P. fallax obscurithorax*  
Santschi (41x)

Figure 36. Head of worker of *P. fallax obscurithorax* Santschi (86x)



## PLATE 7

Figure 37. Thorax of the worker of *P. morrisi* Forel (72x)

Figure 38. Head, thorax, and pedicel of the worker of *P. dentata* Mayr (72x)

Figure 39. Thorax of the work of *P. dentata* Mayr (79x)

Figure 40. Head of the worker of *P. crassicornis* complex (54x)

Figure 41. Thorax of the worker of *P. metallescens* Emery (106x)

Figure 42. Head of the worker of *P. littoralis* Cole (113x)





## PLATE 8

Figure 43. Worker of *P. carrolli* n. sp. (40x)

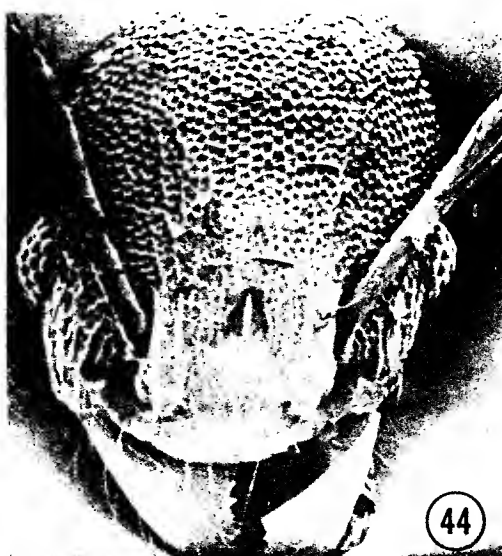
Figure 44. Head of worker of *P. moerens* Wheeler (102x)

Figure 45. Head of worker of *P. greggi* n. sp. (102x)

Figure 46. Mermithid parasitized worker of *P. anastassii* Emery (45x)

Figure 47. Dorsal view of parasitized worker of *P. anastassii* Emery (103x)

Figure 48. Propodeum, pedicel, and gaster of worker of *P. dentigula*  
M. R. Smith (102x)



## PLATE 9

Figure 49. Dorsal view of thorax of *P. dentigula* M. R. Smith, worker (115x)

Figure 50. Head of worker of *P. anastasioi* Emery (109x)

Figure 51. Head of worker of *P. floridana* Emery (115x)

Figure 52. Pedicel of worker of *P. floridana* Emery (193x)

Figure 53. Dorsal thoracic hairs of worker of *P. adrianoi* n. sp. (1,401x and 5,174x, respectively)

Figure 54. Dorsal thoracic hairs of worker of *P. adrianoi* n. sp. (1,401x and 5,174x, respectively)



## PLATE 10

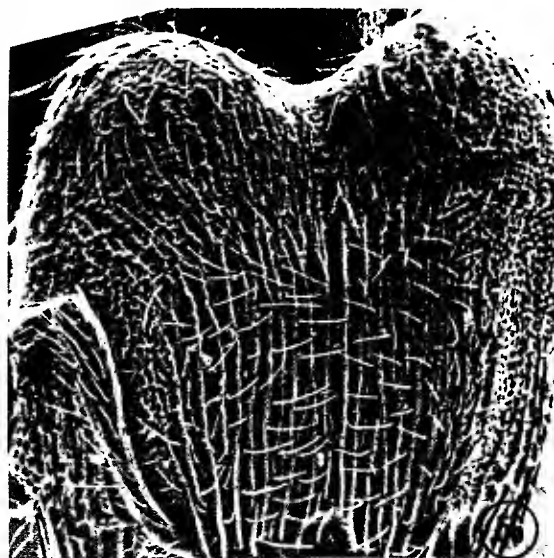
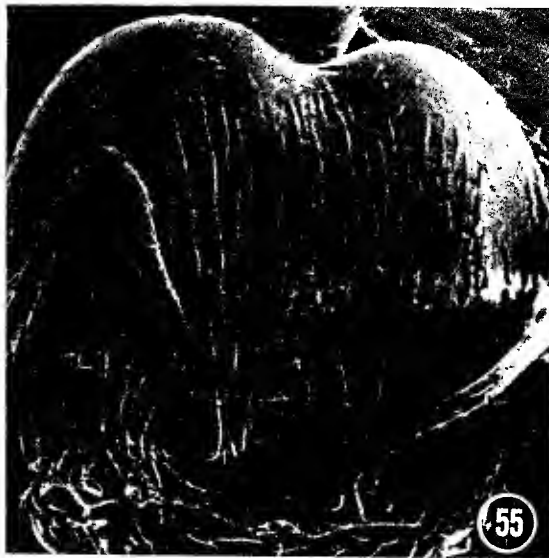
Figure 55. Head of major of *P. flavens* Roger (95x)

Figure 56. Head of major of *P. flavens sculptior* Forel (87x)

Figure 57. Occipital lobes of *P. greggi* n. sp. (250x)

Figure 58. Postpetiole of the major of *P. flavens sculptior* Forel (158x)

Figure 59. Head and thorax of the minor of *P. flavens* Roger (83x)



## PLATE 11

Figure 60. Dorsum of propodeum of major of *P. vinelandica* Forel (272x)

Figure 61. Thoracic dorsum of *P. bicarinata* Mayr (186x)

Figure 62. Postpetiole of *P. bicarinata* Mayr (186x)

Figure 63. Head of *P. vinelandica* (66x)



